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ESSENTIALS OF COMMERCIAL GEOGRAPHY

BY

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PREFACE.

A few years ago Mr. Mukerji brought me the rough manuscript of his book, "The Essentials of World Geography." After careful perusal, I made a number of suggestions which Mr. Mukerji has now followed out. At his request I have again revised the manuscript and have made myself responsible for the illustrations.

Mr. Mukerji is a geography teacher of considerable experience and possesses an intimate knowledge of the mind of the Indian boy. These qualities, combined with his academic training, eminently fit him for the writing of a short introduction to Commercial Geography. The intimate inter-relationship between cause and effect has been carefully stressed, and the book embodies the outlook of the modern geographer. At the same time Mr. Mukerji has his own style and methods of expression which I have endeavoured to leave untouched.

L. D. S.

London, 1927.

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ESSENTIALS
OF
COMMERCIAL GEOGRAPHY

INTRODUCTION.

The Earth on which we live has a deep interest and meaning to us all. Every passing phenomenon claims our attention and we are consciously or unconsciously being acted upon by the things which lie around us. This fact urges some people to assert that we are what nature makes us. We are no doubt largely creatures of our environment, but we, too, mould our surroundings to a marked degree. This constant struggle between man and nature affords much food for serious reflection.

In early times, or in a primitive state, man was almost completely dependent on the resources of the particular spot where he happened to be born and his interests were, therefore, local and narrow. Some natural barrier, a mountain or a river, compelled the people of one valley to live and move in it, content with the things grown or produced there. They did not, indeed, make any serious attempt to go beyond this limit till they grew in numbers and felt the need of more space. For instance in the early days of Greece, the people of one valley had very little intercourse with the people of a neighbouring valley, being shut in by mountain walls. Isolation thus brought about concentration, concerted action and patriotic spirit and thus gave rise to a number of distinct tribes. Even

now we may trace among the Greeks this spirit of patriotism with a strong tribal independence, which was the distinguishing features of the ancient Greeks. Things have quite changed since then, though tribal spirit still exists more or less among all mountain peoples. Though now, with ever increasing facility for transport and communication, men are becoming less and less dependent on the particular place where they happen to be born, yet still the people of the barren tundra depend almost entirely on the reindeer for food, drink, and other necessities of life. Time and a larger knowledge of, and a greater control over, nature may, of course, make us somewhat independent of our environment in future, but at present a fairly intelligent people, not to speak of an uncivilised or semi-civilised one, is to a great extent rich or poor in proportion as nature has been bountiful or miserly. It is indeed very interesting to realise how our energies are guided and controlled by the things which lie round us.

In the days of yore society was very simple and its needs were likewise simple and few. Every man made and procured the things he needed. He was a potter, carpenter, cultivator, etc. In short, he was a jack of all trades but master of none. As man progressed his needs grew apace, and it become practically impossible for a man to procure and make every thing of which he stood in need. He soon found it profitable and advantageous to devote himself to the calling for which he had a special taste and which best suited his genius. It is here that we have the origin of the " division of labour " which has increased the output of the world to a remarkable degree. The blacksmith, when in need of rice, would naturally go to a cultivator in need of agricultural implements ; give him tools, and receive in return the rice and other agricultural products he

wanted. Such an exchange of things is called barter. At that time every village or locality was almost self-contained within its own borders; each village having its own blacksmiths, carpenters, cultivators and so on. The villagers were content with what they could find in the locality where they were born. Perhaps they could not be otherwise, for communication was difficult, so much so that the people of one valley had practically no idea of the people living in another, though it might not have been more than a few miles off. However much one may lament those happy days, they are for ever gone. Society has now grown to be much more complex and its needs have in consequence become multifarious. Many things which are now wanted for food, drink, clothing and ornaments are not and cannot be grown or made in one place, for different climatic conditions and soils are essential for the growth of different plants and crops. Now what cannot be produced or found in a place must be sought elsewhere. Questions, then, naturally arise: whence can we obtain the various things we require, in the largest quantities and of the best quality at the cheapest rate? What things must we give in return? Quality and quantity by themselves will not suffice. Something more is wanted. Supply must be regular. The regularity of supply and the cost of transport will depend on the nature of communication, which in its turn will depend largely on the physical or natural features of the country. The study which considers such questions of production and distribution is commonly known as Commercial Geography. As production depends largely on climate, the latter deserves special consideration.

Before we conclude our preliminary observations it will be useful to have some idea about the general

effect of commerce upon the world as a whole. It would appear on reflection that the world may now be regarded in a comprehensive sense as a market or an exchange house where things are being bought and sold at an advantage both to the seller and the buyer. People under normal conditions part with things they have in abundance or in superfluity in exchange for the things they urgently want. Every individual tries to produce what he can produce well and takes in return what he cannot. Now what is true of an individual is generally true of a nation. So we may say commerce indirectly insists on the scientific principle of division of labour, and is thus a powerful factor in increasing the total output of the world and so, too, its well-being.

CHAPTER I.

Climate.

It is a well-known fact that vegetation depends on climate and soil. A certain amount of air, heat and moisture is essential for plant life. Excessive cold and excessive heat are both harmful to it. The cold tundras exemplify the former and the equatorial deserts the latter. Climate in fact decides where animal and vegetable life can or cannot exist. Everybody is, no doubt, familiar with the word climate and it is almost certain that nearly all of us have some vague idea of its meaning. But a more precise understanding is desirable.

By the climate of a place is meant the general character of its weather. The weather includes the temperature of the atmosphere (heat and cold), its movements (winds), its humidity (dampness and dryness) as well as rainfall. Climate is the average state of the weather. Climate is thus to be distinguished from weather, which means the particular amount of heat, moisture, and wind in a particular place at a particular time. So we have often very bad weather in a place the climate of which is quite good.

The word climate is derived from the Greek word 'Klima' which means slope. The slope of a country has much to do with its climate. The Sun is the source of heat and the heat of its rays varies mainly with their direction. A vertical ray is hotter than an oblique one for it is more concentrated (*i.e.*, covers a smaller area) and passes through less atmosphere. The Sun shines more directly over places near the equator than on the places away from it. Hence other circumstances

remaining the same, the nearer a place is to the equator the hotter it is. As we pass from the

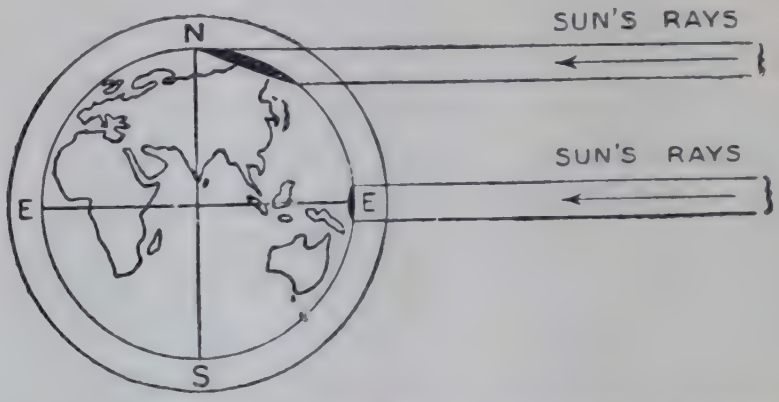

FIG. 1. DIAGRAM SHOWING HOW THE SUN'S RAYS PASS THROUGH A GREATER THICKNESS OF ATMOSPHERE AND COVER A GREATER AREA OF THE EARTH'S SURFACE NEAR THE POLES THAN THEY DO NEAR THE EQUATOR.

equatorial regions, to the north or to the south, we come into parts getting cooler and cooler. Considera-

FIG. 2. THE TEMPERATURE ZONES OF THE WORLD.

tion of this fact has led to the division of the earth into five distinct zones.

These zones are the Torrid Zone, the North Temperate and South Temperate Zones, the North Frigid and the South Frigid zones.

The Torrid Zone extends over 47 degrees, 23½ degrees on each side of the equator. The sun shines vertically in this belt of 47 degrees at least twice during the year at midday; nowhere else in the world is the sun ever vertically overhead. The northern limit is known as the Tropic of Cancer, the southern limit as the Tropic of Capricorn. As the sun's rays fall nearly vertically during noon over this region, they not only pass through less atmosphere and thereby lose less heat during their passage through it by direct absorption, but they also fall in greater numbers over a given area. It is for this reason that the Torrid zone receives the greatest amount of sun's heat and on the whole is the hottest part of the world. The effect of the angle at which the sun's rays strike the earth will be evident from the observation of the difference of heat felt at different periods of day. In the morning when the sun peeps over the horizon the sun's rays reach us obliquely and are spread over a large surface and we do not feel them much, but as the day advances and the sun rises higher and higher in the sky the rays of the sun reach us more and more vertically and, instead of being spread out, are concentrated and, in consequence, appear to us fiercer and fiercer. At mid-day when the sun is highest in the heavens, the sun gives us more heat than at any other part of the day; after midday it gradually climbs down towards the western horizon and its rays reach us more and more obliquely and therefore the heat we get becomes less and less intense till in the evening it becomes almost imperceptible.

Just as the rays of the sun strike a place at different angles at different hours of a day, so they strike any

one part of the earth at different angles at different periods of a year. This is caused by the annual revolution of the earth round the sun with its axis inclined at an angle of $66\frac{1}{2}°$ to the plane of its orbit.

The earth's path round the sun is called its orbit. Its orbit is nearly, but not quite, a circle so that at one part of the year the earth is slightly nearer the sun than at other times. Although the earth moves round the sun once every year, the earth's axis is

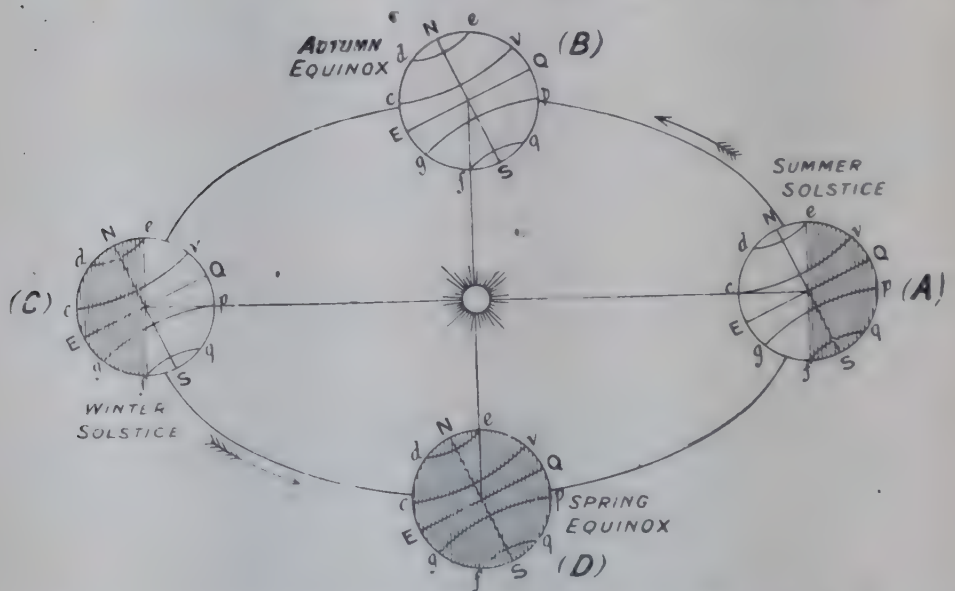

FIG. 3. DIAGRAM SHOWING THE POSITION OF THE EARTH IN ITS ORBIT AT THE BEGINNING OF THE FOUR SEASONS.

always inclined in the same direction. This is very very important for you to understand. You can best picture it by imagining the sun to be in the middle of your class room. If you move the globe right round the room, that is, right round the sun in the centre, you will be imitating the earth's movement round the sun every year. But when you move the globe keep it so that the axis is always leaning over or inclined towards one particular end of the room. This is shown roughly in Fig. 3.

When the globe is in position C you will be able to find a spot which is directly under the sun. Rotate the earth and you will find there is a line along which all places come directly under the sun once a day thus :—

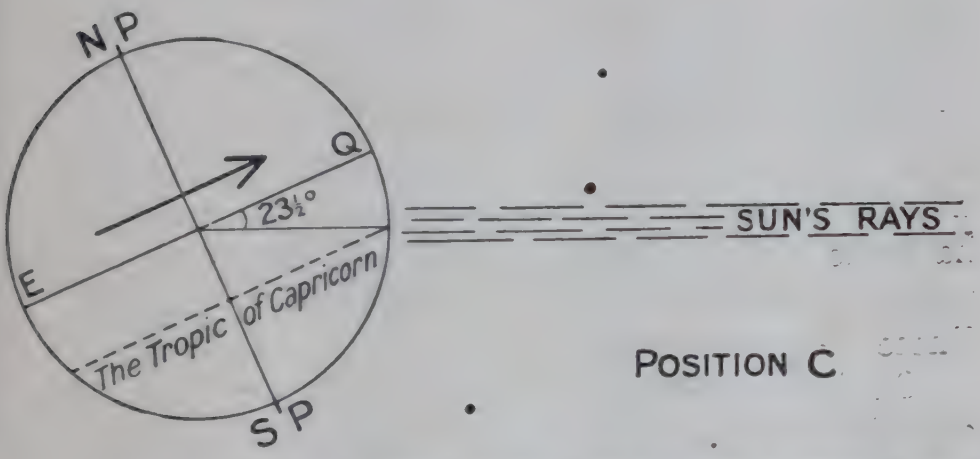

Fig. 4. Diagram to illustrate the position of the Tropic of Capricorn.

We call this imaginary line the Tropic of Capricorn You will find it marked by a dotted line on your globe.

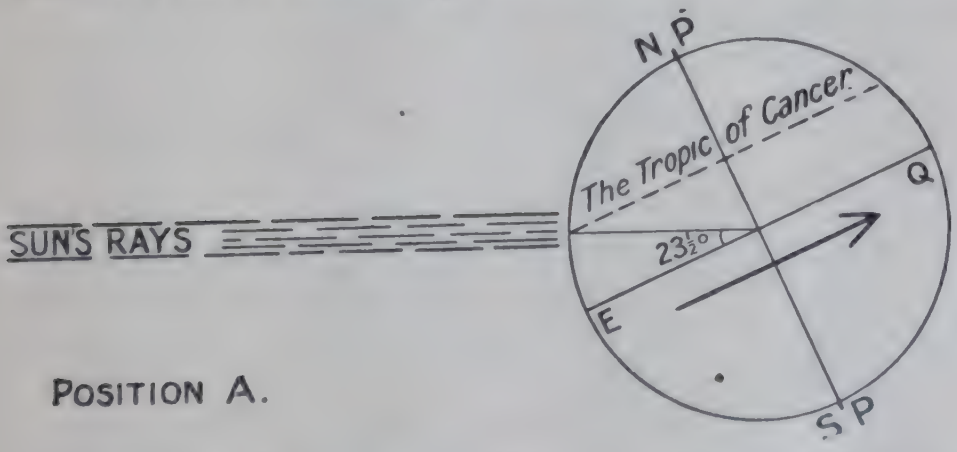

Fig. 5. Diagram to illustrate the position of the Tropic of Cancer.

When the sun is in position A you will be able to trace out another line in quite a different position thus :—We call this the Tropic of Cancer.

When the globe is half way between these two positions we find that the line traced out in the same way is half way between the two poles and is the line we call the equator.

The earth is in position C with the sun shining vertically over the Tropic of Capricorn on December 22nd, which we call the Winter Solstice. Notice that at this time a man standing at the north pole would not see the sun at all. The sun is shining vertically over the Tropic of Cancer at the Summer Solstice, that is, on June 21st. Midway between the two we have the equinoxes—March 21st and September 22nd when the sun is shining vertically over the equator. These differences are the cause of the seasons.

On the 21st March, days and nights are equal all over the earth, and on June 21st the day is longest all over the world in the north of the equator and shortest all over the world on the other side of the equator. In consequence of the combined effect of the longest day and shortest night and the utmost vertical rays, the northern hemisphere has its mid-summer on the 21st June. For the quite opposite reason, *i.e.*, the shortest day, the longest night and the utmost obliquity of the sun's rays, the people in the southern hemisphere have their mid-winter on the same day. On this very day the sun's rays are extended $23\frac{1}{2}^\circ$ beyond the north pole. A circle drawn round the earth at this point is called the Arctic circle and all places within this circle have continuous day light.

From June 21st the sun appears to move gradually southward back to the equator until on September 23rd it reaches the equator again, and, on that day, days and nights are equal all over the world. The sun does not stop here but continues to move on southward till on the 22nd December it reaches a point $23\frac{1}{2}^\circ$ south of

the equator and then turns to resume its journey towards the north. As we have already learned, the line drawn round the earth through this turning point and parallel to the equator is known as the Tropic of Capricorn. On December 22nd the rays of the sun reach $23\frac{1}{2}°$ beyond the south pole. A circle drawn round the globe at this point is called the Antarctic circle and places inside this circle will have continuous day light. On this very day, *i.e.*, 22nd December, the day is shortest in the northern hemisphere and longest in the southern and, therefore, for reasons already explained in the previous paragraph it will be mid-winter in the northern hemisphere and mid-summer in the southern.

The belts of the earth lying between the Arctic circle and the Tropic of Cancer and between the Tropic of Capricorn and the Antarctic circle are respectively called the North Temperate and the South Temperate Zones. The belts of the earth inside the Arctic and Antarctic circles are in the same way known as the North Frigid and South Frigid Zones. The belt of the earth, as already noticed, between the Tropic of Cancer and the Tropic of Capricorn is known as the Torrid Zone.

It will be evident from what we have just now said and the figures, that the variation of the length of days and nights increases with distance from the equator. Within the tropics it is comparatively unimportant. At the equator day and night are equal throughout the year and in no part of the Torrid Zone does the duration of day and night vary greatly. At the tropics the longest day is a little less than 13 hours and a quarter and the shortest about 11 hours. In the latitude of 45° the longest day is 15 hours 26 minutes and the shortest day 8 hours 34 minutes, and in the

latitude of 60° the longest day is 18 hours 30 minutes and the shortest 5 hours 30 minutes. Along the Arctic circle the longest day is of exactly 24 hours duration and the sun, as already observed, at the period of the summer solstice remains above the horizon for the whole of that period.

The relative length of the day and night at opposite seasons is an important factor in the determination of climate. The sun gives heat during the day time and during the absence of the sun at night the heat is given up by the earth. Within the Torrid Zone where the variation of the periods of day and night is not great the variation of temperature between summer and winter is likewise small. As the variation of the period of sunshine and darkness increases with approach towards the poles the intensity of summer heat and winter cold also tends to increase proportionately. This is one reason for the extremes of climate in high latitudes.

In whatever part of the earth a place may be, if it slopes towards the sun, it will get more vertical rays than if it is level or slopes away from the sun. This is the reason why the southern slopes of the Alps in Italy get more sunshine than the level fields which extend southward from their base. For the same reason the southern slopes of the South Downs in Sussex get more sunshine than the level lands in the same latitude. This has led to the planting of fruit trees on the southern aspect of the hills in the Northern Hemisphere and on the northern aspect in the Southern Hemisphere. For instance, the finest grapes in Spain are grown on the south-eastern slopes of the Sierra Nevada. So also fine peaches are grown on the northern slopes of the mountains in New-Zealand.

Though latitude is a great factor in determining the climate of a place yet there are other circumstances which are no less important. A slight elevation in height above the sea brings about a great change in the climate of a place. Generally the temperature of the air falls as one goes upward from the level of the sea, and a region of polar cold may be reached, in every part of the earth, by an ascent of a few thousand feet. In fact an ascent of 300 feet causes a fall of 1° (Fahrenheit) in the temperature of the air. Mountain tops even on the equator are found to be clothed with perpetual snow, if they are more than 16,000 feet high, *e.g.* Mount Kenya in East Africa. It is on account of the cold of the places at high levels, that hill stations like Darjeeling, Simla and Mussouri in India, and Maymyo and Kalaw in Burma are visited by thousands of people during summer.

It must not be understood from what has just now been said that there is uniformity in the fall of the temperature of the air with ascension. The decrease of temperature does not maintain uniform ratio, but temperature does ordinarily show a decrease with increasing altitude. Sometimes one finds a rise of temperature occurring at great elevations while passing through a particular layer of air and then suddenly one comes to a region of much lower temperature. This is obviously due to passing through a current of warm air followed by a cold one. The ratio of the fall of temperature in the atmosphere differs also in summer and winter. Notwithstanding this, the general statement that temperature decreases with altitude is correct. In ascending a lofty plateau or a high mountain the same changes of temperature and succession of vegetation are observed as would generally be found in travelling from that station to the

polar regions. In order to explain this decrease in temperature we must regard the air as a blanket keeping the earth warm. In the upper layers of the atmosphere the " blanket " is thin, the earth loses its heat quickly and so both the mountain tops and the surrounding air are cold.

This will help you to understand what is meant by the pressure of the atmosphere and why it is much greater at sea level than it is on mountains.

The air pressure at sea-level is affected by several factors.

(1) Temperature. Heat causes air to expand and become less dense and so the pressure is low.

(2) Air with much water vapour is lighter than air alone. So in India the pressure is less in the Rainy Season when the air is damp.

When we look at the world as a whole we find there are certain marked ' high pressure belts ' and certain marked ' low pressure belts,' arranged as follows :—

1. Low Pressure Belt round the equator.
2. High Pressure Belts just outside the tropics in both Northern and Southern Hemispheres.
3. Low Pressure regions over the cold regions round the North and South Poles, except near the poles themselves.

1. The Equatorial Low Pressure Belt is caused by the great heat making the air hot and so light, by the large quantity of water vapour—the air is always damp in this belt. The rotation of the earth tends to swing the air away from the earth at the equator.

2. The Polar Low Pressure areas are caused largely by the rotation of the earth. The envelope of air is thin here, or the rotation swings the bulk of the air towards the equator. At the poles themselves there are high pressure centres, probably caused by extreme cold.

3. The High Pressure Belts. It is reasonable to expect a belt of High Pressure near the Tropics between the two belts of low pressure and this is exactly what we do find.

Notice the movement of the air in the upper part of the Atmosphere. The heated air at the equator rises and flows away polewards. It becomes cooled and

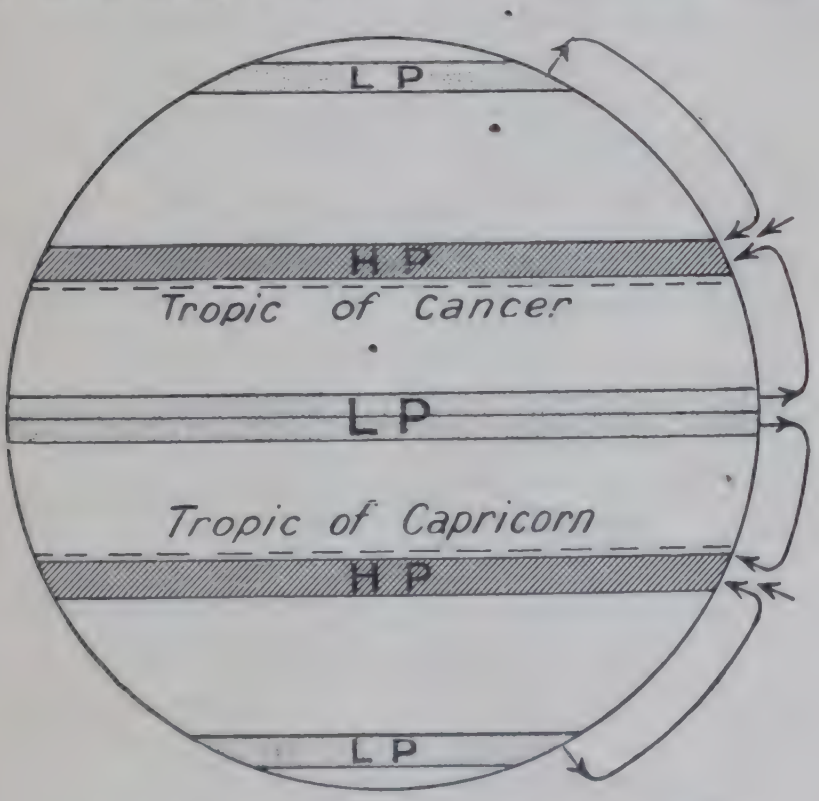

Fig. 6. The Pressure Belts of the World.
H. P. = High Pressure. L. P. = Low Pressure.

commences to sink towards the earth along the high pressure belts.

Wind is the air in motion. The principal cause of winds is difference in pressure. Air always moves from a region of high pressure to a region of low pressure. You have already learnt the main belts of high pressure and low pressure on the earth and as the regular

winds result directly from these pressure belts, we will consider them at once.

Both the high pressure belts are regions of no wind and so are called the Calms of Cancer and the Calms of Capricorn. The low pressure belt round the equator is also a region of calm and this belt of calms is known as the Doldrums. Although there are no regular winds there, violent thunderstorms are

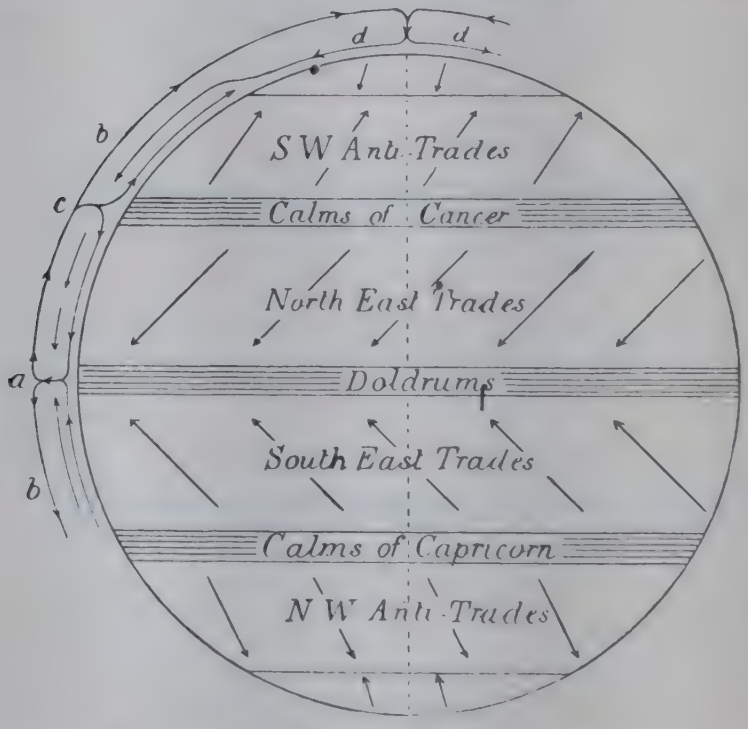

FIG. 7. THE WIND SYSTEMS OF THE GLOBE.

frequent. If the earth were still we should have north and south winds blowing direct from a place of high pressure to a place of low. But the earth is not still, it is rotating daily on its axis and moves from west to east (*i.e.* opposite to the direction in which the sun and stars appear to move).

Within the tropics, that is in the Torrid Zone, we have winds blowing from the high pressure belts towards the equator. These are the very important

Trade Winds. They were given this name by Europeans in the days of sailing ships because the North-East Trade winds blew the European vessels across to the rich lands of the West Indies and so helped trade with those lands. North of the equator we have the North-East Trade Winds, south of the equator the South-East Trade Winds.

These winds are usually very regular and constant,

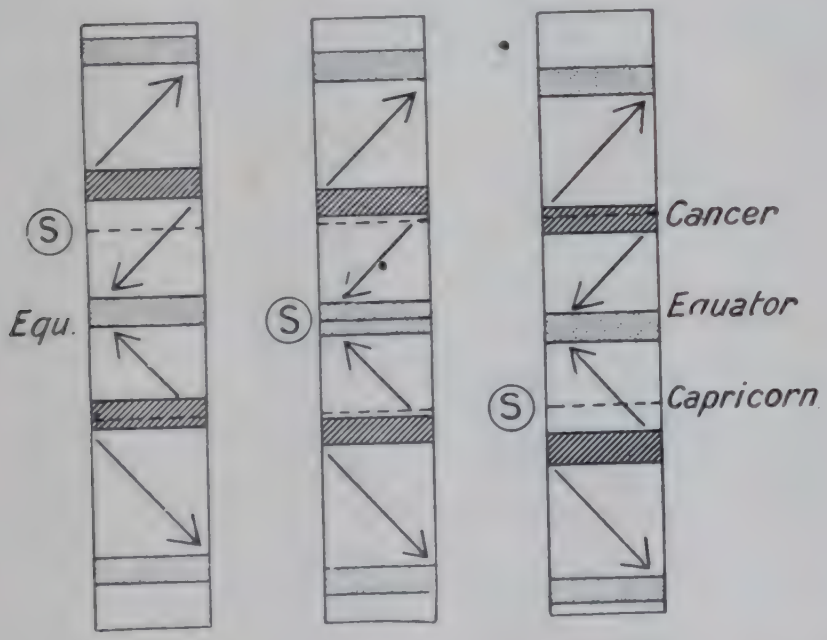

FIG. 8. DIAGRAM SHOWING THE SWING OF THE WIND SYSTEMS ACCORDING TO THE POSITION OF THE OVERHEAD SUN (S).

especially over the sea, but you must note that the position of the high pressure belts changes somewhat according to the season. During our Rainy Season, that is, in June, the sun is shining vertically over the Tropic of Cancer—that is north of the equator—the high pressure belt with the Calms of Cancer is found well to the north and lands as far north as 45° come within the influence of this belt. At the same time of

year the Calms of Capricorn are in their northernmost position. In other words the whole wind system of the world swings northward with the sun. In our Cold Weather, on the other hand, when the sun is shining vertically over the Tropic of Capricorn the whole wind system swings southward. Study this very carefully in the diagrams.

Anti-Trade Winds.—These winds blow outside the Tropics, in the Temperate Zone. In the Northern Hemisphere they blow mainly from the south-west (South-West Anti-Trades); in the Southern Hemisphere mainly from the north-west (North-West Anti-Trades). They are not so constant in strength or direction as the Trade Winds and are often called just "Westerly Winds." Notice that they swing north and south too according to the seasons. They are more regular in the Southern Hemisphere, where they are not interrupted by land masses and may become so strong that between latitudes 40° and 50° they are known as the "Roaring Forties."

Polar Winds.—During most of the year bitterly cold winds blow from the poles towards temperate regions. Where there are no mountain chains to interrupt them these winds often cause the climate to be bitterly cold even far to the south as they do in the central plains of North America.

Land and Sea Breezes.—During the day the land becomes more quickly heated than the sea. Consequently the air over the land becomes more heated too. It expands and rises and the cool air from over the sea flows in to take its place. This causes a sea-breeze. Many places in India on the sea coast would be very hot were it not for this cooling breeze from the sea. During the night the land cools more rapidly than the sea and some hours after sunset the air over the land

is colder than the air over the sea with the result that the cool, heavy air from the land flows out to sea as a land breeze.

Monsoons.—In the last paragraph you learnt how the land in getting very hot during the day caused the air above it to get hot, expand and rise. The cool air from the sea blows in to take its place causing a sea breeze. On a very much larger scale you can imagine the air over a great mass of land becoming very hot during the hot weather until it expands and rises and causes a great cool wind to blow in from the

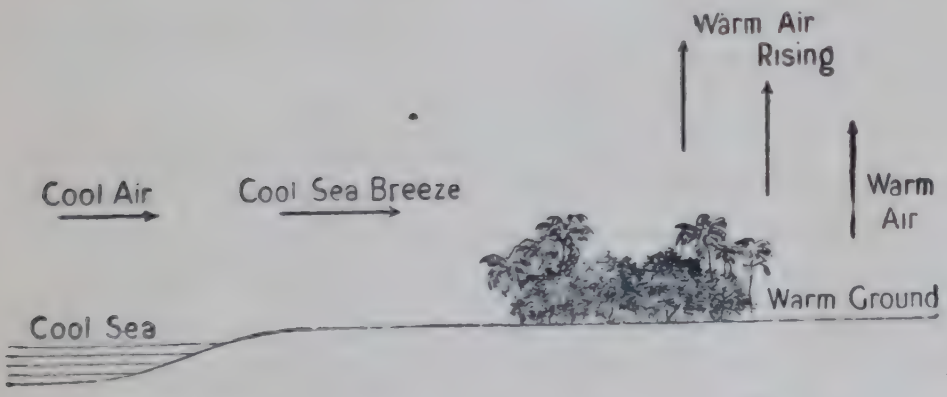

FIG. 9. DIAGRAM SHOWING HOW SEA BREEZES ARE CAUSED.

sea and take its place. This wind is a Monsoon Wind. "Monsoon" comes from an Arabic word "mausim" meaning "season" and in India we often talk about the Monsoon when we mean the rainy season. In geography books 'monsoon' usually means the wind which blows at this time. In India in the hot season the sun is shining vertically over the heart of the country —that is nearly over the great plains of the Indus, Ganges and Brahmaputra—until about May the air has become very hot. Normally at this time the North East Trade Wind—or the North-East Monsoon as we

often call it in India—is blowing, but the rising of the hot air causes this wind to be completely reversed and the South-West Monsoon commences to blow. This change is accompanied by severe thunderstorms. Monsoon winds do not, of course, always blow from the South-West. Even in India the high mountain ranges change the direction of the winds. It is easier for the wind to blow parallel to the mountain chains than across them. In China the great land mass is to the North-West and the sea to the South-East. So the monsoon blows from the South-East. India, Indo-China, China and North-West Australia are the most important Monsoon countries but monsoon winds are also found in other parts of the world. Look carefully at a map of the Indian Ocean. You should notice that the South-East Trade wind is really drawn or sucked right across the equator and becomes the South-West Monsoon in India. During our cold season the North-East Trade wind (or North-East Monsoon of India) is drawn across the equator and becomes the North-West Monsoon of Australia.

Local Winds.—The presence of high mountains, hot deserts, etc., often causes special winds which receive special names in different parts of the world and about which you will learn later. Some of them like the Sirocco which blows from the Sahara Desert across to Italy are very hot, others which blow down from the mountains are very cold.

Another very important element of climate is rain. In order to have rain two important conditions must be satisfied. Firstly we must have moisture-laden air; secondly there must be some means whereby the air is cooled and condensation takes place. The air obtains its water vapour by evaporation from the surfaces of great areas of water, usually from the sea.

This moisture-laden air may be cooled in two principal ways :—

(a) by rising upwards into the colder upper regions of the atmosphere.

(b) by being blown as wind to colder regions.

At the equator evaporation is very great and, as you have learnt, water vapour is lighter than dry air and so readily rises. It soon expands, cools, and rain falls. Rains which originate in this way are called Convectional Rains. This explains the very heavy rainfall which is found all the year round in the Equatorial Belt. Evaporation is greatest near the Equatorial Belt and that is one reason why rainfall is greater than in temperate regions. Apart from convectional rains the rainfall of a country or a place depends upon the following factors :—

1. The Direction of the Prevalent Winds.—When warm winds blow towards a cooler region, the decrease in temperature causes condensation and rain falls. The Anti-Trade winds blowing from warm to cooler regions bring rain, whilst in the case of the Trade winds, which blow from cooler regions towards the equator, the rise in temperature prevents precipitation, and little rain falls except where the path of the winds lie across mountains or hilly country.

2. The presence of land masses, especially mountains, tends to condense the water vapour. When the moisture-laden wind reaches mountainous land it is forced to rise. In rising, it becomes cooled and rainfall results. Such rains are called Relief Rains. The South-West Monsoon, laden with moisture from the Indian Ocean, brings abundant rain to the Western Ghats and to the slopes of the Himalayas or the Khasia Hills. We have learnt that monsoon winds invariably blow from the sea on to the land and

so are nearly always rain bearing winds. That is perhaps why many people when they speak of the monsoon mean the *rain* rather than the wind.

When a moisture-laden wind is forced to rise to pass over a mountain range, it must be cooled and is sure to lose some of its moisture. The higher the

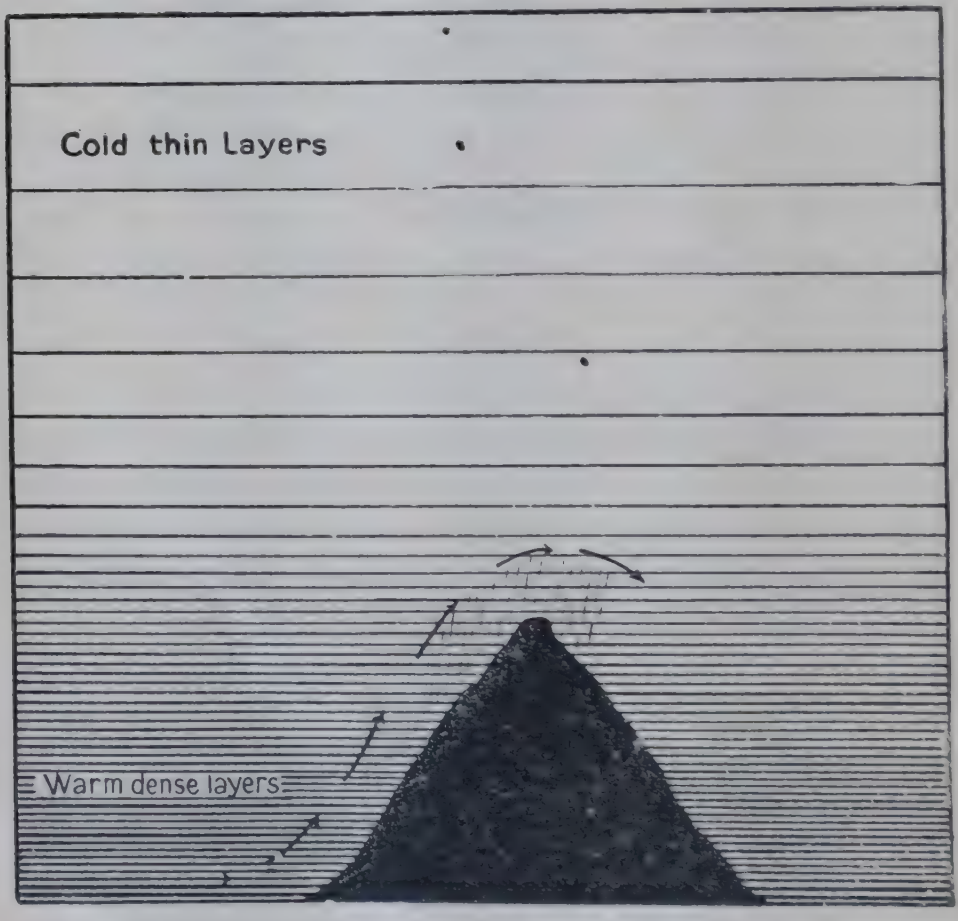

FIG. 10. DIAGRAM SHOWING THE CONNECTION BETWEEN RISING AIR AND RAINFALL.

mountains the more moisture is lost. When the wind has finally passed over the range, it is almost a dry wind. Further, when the wind drops to the lower ground it is warmed rather than cooled and so becomes a thirsty wind and not one which is ready to shed any

of its moisture. That side of a mountain range which faces the rain bearing wind and receives the rain we call the windward side; the dry side we call the lee-side or leeward side. The land which is kept dry in this way by a mountain range is said to be in the

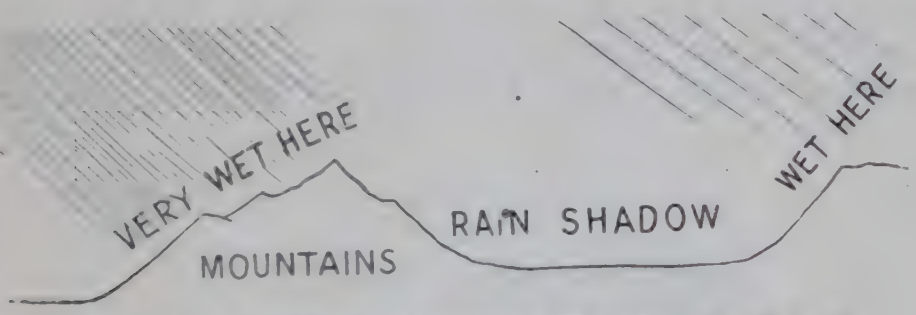

FIG. 11. SECTION TO ILLUSTRATE THE MEANING OF RAIN SHADOWS.

"Rain Shadow" of the mountains. The rains which fall on the leeside are mainly convectional or cyclonic rains. A large part of the Deccan of India is in the Rain Shadow of the Western Ghats, the Dry Belt of Burma is in the Rain Shadow of the Arakan Yomas.

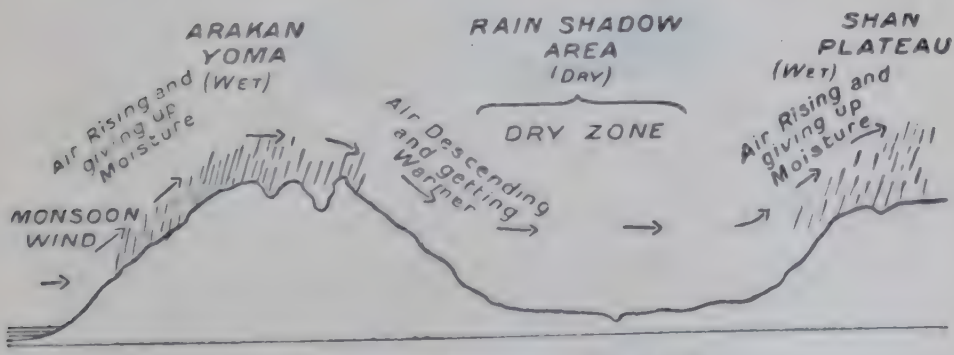

FIG. 12.

On the rainy Arakan Coast of Burma the rainfall is 200 inches, in the centre of the Dry Belt it is only 20.

Hence almost every mountain has a wet and a dry side. The wet side is often covered with forests which

yield valuable timber. The dry side, on the other hand, yields grass on which cattle and sheep thrive. For instance the wet slopes of the Southern Alps in New Zealand still yield valuable timber, whereas the dry side of the same mountains is noted for the celebrated Canterbury mutton. Christchurch and its port Lyttleton export large quantities of mutton, wool, tallow, and other animal products every year to Great Britain.

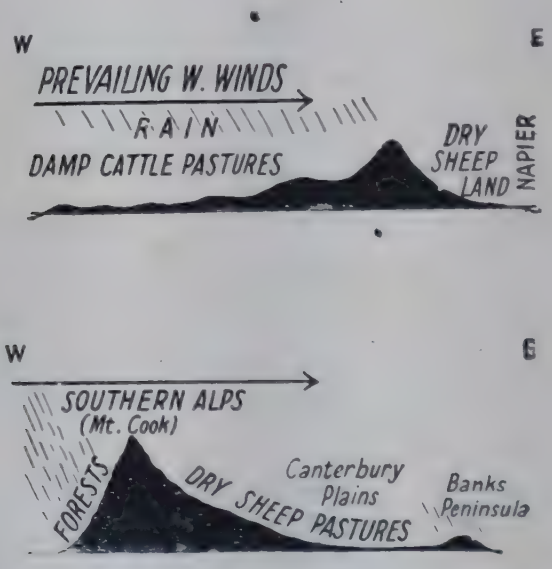

FIG. 13. SECTIONS ACROSS NEW ZEALAND.

It would be evident from what we have just now said that rain and winds are closely connected. The winds distribute the moisture of the atmosphere, the amount of rainfall depending on the configuration of the land, as already noticed, and on the temperature and surface of the place from which they blow. The amount of precipitation will, however, depend also on the direction in which the winds blow. If they blow from the colder to warmer parts, *i.e.*, from the higher to lower latitudes, the rainfall will not be heavy, but if

on the other hand, they blow from hotter to colder regions, *i.e.*, from lower to higher latitudes, the rainfall will be heavy. In the first case, the temperature of the winds will not be reduced so as to compel them to give up rain, save where the relief of the land forces them upwards; but in the second case, the temperature of the winds will be reduced by mixing with the cooler air of the higher latitudes and the winds will give up a good amount of moisture even in places where they are not forced to climb mountains. For example Trade Winds which blow from higher to lower latitudes do not as a rule, bring as much rain to a country as Monsoon Winds, but Anti-Trade Winds as they blow from warmer to cooler regions, bring plenty of moisture to the countries over which they blow. In any place, if the prevalent winds blow from a warm ocean or a sea they will be moist and be ready to deposit the moisture when chilled in their passage over the land. If, on the other hand, they blow over the land, they will be dry. Their temperature will, however, depend upon the land from which and over which they blow. The north-east monsoons which blow over the land mass of Asia in winter are cold and dry, for they blow from the cold Arctic regions whereas the winds that blow outwards in all directions from the Sahara and other tropical deserts are hot.

As the ocean supplies most of the vapour of the atmosphere, the condensation of vapour of the atmosphere into rain upon the land is greatest near the coast-line, and under normal circumstances the rainfall decreases, as we proceed inland from the coast. In fact the interior of all large continents is lacking in moisture. But sometimes a desert is found very close to the sea. This is either due to the fact (1) that the regular winds blow outwards from the land

under consideration towards the sea or (2) that the particular region is too low for condensation. The great deserts of Western Australia owe their origin to the former, and the Thar desert of Rajputana in

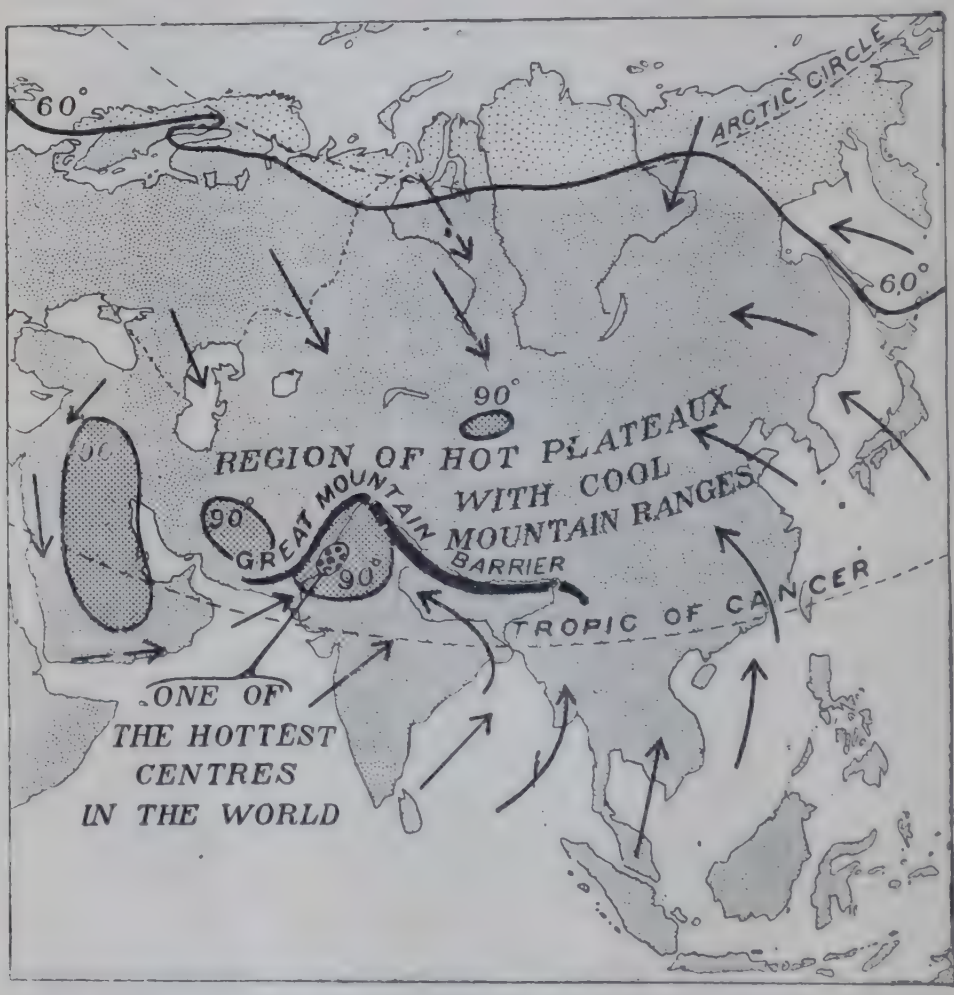

FIG. 14. THE WIND SYSTEM OF ASIA IN THE HOT SEASON OR (JULY) SUMMER.

India to the latter. So we may conclude that the greater the distance from the sea the drier the climate ought to be.

The greatest advantage of nearness to the sea is that it renders the climate equable. Water has a much

greater capacity for heat than land. It, therefore, takes in heat much more slowly and gives it out much more slowly than land. This unequal heating power of land and water gives rise to differences of tempera-

FIG. 15. THE WIND SYSTEMS OF ASIA IN THE COOL SEASON (JANUARY).

ture which cause the land and sea breezes already described. The result is that it raises the temperature of the adjacent land at night and in winter, and lowers the temperature during the day and in summer. Hence we find that the annual range of temperature

for any given latitude and altitude increases with the distance from the sea.

Ocean currents, too, have a marked influence on climate. They are either warm or cold. The warm currents flow from the equator towards the poles and the cold ones from the poles towards the equator. Together with winds they are the great agents for (1) the distribution of heat and cold and (2) the distribution of moisture. The warm Gulf Stream-Drift from the Gulf of Mexico carries heat along with it and keeps the coasts of the British Isles and Norway warm and free from ice all the year round, and enables barley to be grown far into the Arctic Circle in Norway, while the Baltic Sea, which is much further south, freezes during winter. Again, the warm Japan streams renders the climate of British Columbia quite comfortable and warm, and Vancouver is an open port throughout the year. The cold Labrador current from the North, on the other hand, makes the climate of Eastern Canada inhospitable and trying. The mouth of the St. Lawrence remains ice-bound for nearly six months of the year. Quebec, near its mouth, though about 300 miles nearer to the equator than Vancouver, is only a summer port of Canada, Halifax and St. John are her winter ports.

The influence of currents on the climate of a place has already been noticed. In fact, winds and currents are inseparable, the latter being mainly the effect of the former. The effect is quite evident in the Atlantic Ocean. The North-East and South-East Trade Winds give rise to two currents on either side of the equator. They blow towards the west and would have flowed round the world were it not for the continent of South America which deflects them northward

and southward. Such currents are commonly called *drift-currents*.

Besides helping in the formation of drift-currents, the winds carry heat from tropics to cooler regions and the low temperature of the polar areas to warmer latitudes. Thus they are important agents in distributing the heat given by the sun. Had there been no winds and currents, there would have been greater difference in temperature between the equatorial and polar regions. The equatorial regions would have been still hotter, and so unfit for human habitation, while the tundra regions of the Northern Hemisphere would have extended still further southwards. The winds also serve as great moderators, because they reduce the temperature of the equatorial regions by a constant supply of cold air from the belts of high pressure in the tropics and raise the temperature of the places nearer the poles by a constant supply of warm air from the tropics. The moist, warm westerly winds keep the western side of Great Britain moderately warm and moist even in winter, while the cold, dry Siberian winds render its eastern side cold and dry in the same season. This will be evident by a glance at the isothermal lines of Great Britain which in winter run north and south, instead of east and west. Again, hot, dry winds from the Sahara make the climate of Southern Europe dry and hot in summer. In winter the same region is protected from the cold dry North-East winds by the Alpine ranges and their continuations, but the Black Sea in the same latitude is frozen, for it is exposed to cold, dry Siberian winds.

The character and condition of the soil also affect climate to some extent. If the soil is pervious it is sure to be dry, for the rain water will rapidly sink down. If the soil, on the other hand, is impervious it will

Warm Currents shown thus:
Cold " " " "
ARCTIC OCEAN
Greenland
Spitzbergen
Iceland
Arctic Current
British Isles
Gulf Stream
North America
New York
Sargasso Sea
North Equatorial Current
Equatorial Counter Current
South Equatorial Current
Europe
Africa
Asia
Australia
South America
Pacific Ocean
Atlantic Ocean
Indian Ocean
Kuro Siwo Current
Antarctic Current
Brazilian Current
Cape of Good Hope
Cape Horn
Meridian 0 of Greenh.
Walker & Boutall sc.

retain water much longer. It has been noticed in a preceding paragraph that water becomes hot or cold much more slowly than land. Evidently then, the pervious soils which retain less water will be more rapidly heated or chilled than the impervious soils which retain more water. This partly accounts for the great difference in temperature between the day time and the night time in a tropical desert, the soils of which are sandy and loose. For the same reason, the range of temperature between day and night and between summer and winter of a marshy place is smaller.

Before we leave the chapter on climate, it is worth noting that the dry air is more conducive to health than damp air. The stalwart figures of the people of the Iran plateau as contrasted with the lean bodies of the people of the Lower Ganges are quite enough to illustrate this truth. If we proceed from Assam towards the Punjab it will be found that the climate becomes drier and drier, and the people are also generally found to be stronger and better developed physically.

CHAPTER II.

I.—Regional Divisions of the World.

It is evident from what has been said in the previous chapter that the two essential elements in climate are (*a*) temperature and (*b*) rainfall. In accordance with the amount and distribution of these two factors the world may conveniently be divided into a number of climatic regions. Of these regions the principal types are :—

(1) **Equatorial Regions.**—High temperature and rain at all seasons *e.g.*, Central Africa, the Amazon basin and Central America, here evergreen tropical forests are found in all their grandeur and complexity.

(2) **Monsoon and Tropical Regions.**—High temperature and rains during summer. These conditions prevail in

(*a*) the south-east of Asia and the other monsoon lands.

(*b*) Tropical Africa and Tropical South-America, outside the regions of constant rain.

(3) **Tropical Desert Regions.**—High temperature and very scanty rainfall. These are the special features of tropical deserts and semi-deserts.

(4) **Temperate Desert Regions.**—Fairly high summer temperature, cold winters and scanty rainfall, *e.g.*, Mongolia, Tibet, Peru, Bolivia and other mountain walled plateaux.

(5) **Warm Temperate Regions.**—Hot summer, fairly warm winter with good rainfall mainly in

the summer months, *e.g.*, South-eastern United States, China.

(6) **Mediterranean or Winter Rain Regions.**—Fairly high summer temperature and rains during cool winter, *e.g.*, the Mediterranean regions and the other countries nearly in the same latitude, both in the Northern and the Southern hemispheres, on the western sides of the continents.

(7) **Temperate Grassland Regions.**—Hot summer, severe winter and scanty rain during spring, *e.g.*, South Eastern Russia between the Black and the Caspian Seas, Central Asia, North-western Mongolia and the heart of North America.

(8) **Temperate Oceanic Regions.**—Cool summer, moderate winter, rain at all seasons with comparatively little variation between summer and winter, *e.g.*, Western Europe, Western margin of North America extending from the South-western point of Alaska to Columbia river in the United States of America. These regions are all on the western margin of the continents, under the influence of the westerly anti-trade winds.

(9) **Temperate Eastern Margins of the Continents.**—Fairly high summer temperature, severe winter and moderate rainfall at all seasons, but maximum in summer. These conditions prevail in the St. Lawrence basin (Eastern Canada), Manchuria and Amuria.

(10) **Cold Temperate Regions.**—Cool, short summer, very cold, long winter with a small rainfall or snowfall at all seasons, *e.g.*, northern portions of Eurasia and of North America.

(11) **Cold Desert or Tundra Regions.**—Cool, very short summer, very long, cold winter, *e.g.*, extreme north of Eurasia and of North America.

(12) **Mountain Regions.**

I. Equatorial Regions.

The Amazon basin of South America, the Guinea Coasts and the Congo basin in Africa all have climatic conditions so markedly different from the rest of the world that they may reasonably be taken together. In these places the temperature is high at all seasons, and the rain falls throughout the year. This combination of great heat and moisture has given rise to what is known as hot, wet or evergreen tropical forest. The vegetation is characterised by the wonderful variety, size and luxuriance of trees and other plants. The ground is covered with a thick undergrowth of creepers through which it is sometimes almost impossible to cut a path. The forest is often so dense that the sun's rays are almost shut out and it is, therefore, almost always dark.

Similar forests are found in the extreme south-east of Asia, Central America and the Indies. The two essential elements, heavy rain and high temperature, are also present in these places. The regions all lie within a few degrees of the equator, where constant winds do not occur.

The resources of such forests are as yet little exploited. The trees of commercial value are rubber in the Amazon and Congo basins, guttapercha in the East Indies, the oil-palm in the Guinea Coasts and hard cabinet woods such as ebony, mahogany and rose-wood. Ebony is chiefly found in Ceylon and Madagascar: Mahogany in the West Indies and

FIG. 17. MAP OF THE WORLD, SHOWING THE HOT, WET FORESTS.

Central America, and Rose-wood in Brazil. The other products are quinine, sarsaparilla and ipecacuanha, Quinine is obtained from the Cinchona of South America, which has also been planted in India, and Ceylon; sarsaparilla and ipecacuanha are obtained from the trees of tropical America. *Hevea baziliensis*, the rubber tree of the Amazon has been introduced into the old world and most of the rubber of commerce is now obtained from plantations in Ceylon, Malaya and the East Indies. In the Equatorial regions agriculture is little developed, mainly owing to the difficulty of clearing the forest.

II (a) Monsoon Regions.

There is a large mass of land in the south-east of Asia which has two prominent climatic features, a very wet, hot summer and a fairly dry winter. It includes India, Indo-China, the southern portion of China proper and the southern portion of Japan. These are commonly known as the Monsoon lands. They have inflowing winds during summer, the wet season, and outflowing winds in winter, the dry season. The north-east wind or dry monsoon blows over the land mass of Asia from October to April and the south-west or wet monsoon blows from the Indian Ocean, landwards from May or June to September. Violent storms and cyclones occur at the change of the monsoons. Rains fall heavily on the windward slopes of the mountains and at their bases, and on the highest mountains the moisture is at once condensed into snow. These heavy rains and snowfall have given birth to many large rivers of never-failing water. They are fed by rains during the wet season, when they swell greatly, and are kept from becoming dry

during the hot dry season by the melting of the snow. The natural vegetation of these lands, except in the wettest parts, is forest or scrubland which loses its leaves during the hot season.

The basins of the mighty rivers of the monsoon lands have always been noted for the wonderful fertility of their soils. The magnificent soils and easy transport by water have drawn the people to agriculture and they supply the rest of the world with a great variety of products. The chief products are rice, sugarcane, cotton and tobacco. Other products include linseed, opium, tea and coffee. Tea and coffee are grown at various elevations on hill sides. Silk is a very important product in south-eastern China and Japan. The mulberry trees which are essential for the feeding of the silk-worms are found there in abundance.

The dense forests yield teak and other timber. The timber is not as hard as that from the equatorial regions and so is more valuable. The forests also yield bamboo, valuable grass. Cinnamon and other spices are grown locally. On the leeward slopes of the mountains and other places with small rainfall the pastoral industry is largely carried on. So we see that the main occupation of the people of this region is agriculture, though a great many of them are engaged in cattle rearing, dairy-farming, mining, and forestry.

A monsoon region occurs in the north-west of Australia and very similar lands are to be found on parts of the coast of Guinea, in Zanzibar and British East Africa (former German East Africa). In North America the south-east of the United States has a somewhat similar climate and resembles India and southern China in many respects. The greater part

of China and the south-eastern United States of America have, however, rather less heat and moisture and may be called " Warm Temperate Regions." It is natural, that the products of this part of the United States of America should be similar to those of south-eastern Asia. The main difference lies in the fact that maize occupies more land than rice, which is grown largely only in the swampy delta of the Mississippi.

II. (b) Tropical Regions.

Outside the regions of constant equatorial rains, there are large areas in Africa which enjoy a summer rainfall and are, therefore, very like the monsoon regions. The characteristic vegetation is the Savanna, a rich grassland with scattered trees. As they lie within the tropics, these grasslands are warmer and wetter than temperate grass lands. They have two seasons, a comparatively short rainy summer and a dry winter. Though the annual rainfall is in some places as much as forty inches and upward, yet it is inadequate for the growth of forests, for evaporation is very great in these latitudes. The result is that long grass grows luxuriantly during the wet summer, and there are trees here and there in the midst of the tall grass which often grows to a height of six or seven feet. Trees like the palm, acacia, eucalyptus which can resist long drought are to be seen, but they do not grow in large numbers. They are found singly or in groups. During the dry season the grasses become dry, turn brown, and wither away. Maize and millet are the chief crops; the former is grown in wetter parts and the latter in drier areas. Cotton and tropical fruits are grown in places where irrigation is possible. Wheat is also grown in some places.

FIG. 18. MAP OF THE WORLD, SHOWING THE TROPICAL GRASSLANDS.

Typical savanna lands cover huge areas in Africa but similar lands exists in Columbia, Venezuela, and the highlands of Guiana. They also occupy the drier parts of Indo-China, southern China, and northern Australia. Much of Brazil outside the Amazon basin is a savanna land. The grassy downs of Australia even in the south resemble more the tropical grasslands than the temperate ones. They are all on the west side of the eastern highlands of Australia. Though cultivation is making progress under irrigation, the chief occupation of the people of the downs is stock-raising.

III. Tropical Desert Regions.

There are some big masses of land round the tropics on the western sides of all the continents. They all agree in having two climatic conditions (1) a very high summer temperature and (2) a slight rainfall. This combination of high temperature and small rainfall is responsible for lack of vegetation. They are called hot deserts to distinguish them from the barren regions within and in the vicinity of the Arctic circle. The latter are known as the tundras or cold deserts. The deserts vary in size with the breadth of the land masses. They are very big in Northern Africa and Arabia where the Old World is very extensive. The Arabian deserts are continued eastward with a few breaks through Persia, Afghanistan, and Baluchistan till the deserts of Sind and Rajputana in India are reached. In the Southern Hemisphere deserts cover a large area in the centre and western parts of Australia. The other remarkable hot deserts are the Chile-Peru desert in South America and the Kalahari desert in South Africa. All these deserts lie in the high pressure belts along the two tropics (Cancer and Capricorn) or under

the influence of the trade winds, which, blowing from the land, bring little or no moisture.

It is a well-known fact that plants cannot exist without water and that the higher the temperature the greater the amount of moisture needed for vegetation. It is no wonder therefore, that these regions are almost devoid of vegetation. A few thorny and prickly plants which can exist almost without water are found here. The loose, sandy soil is often scattered with stones, and water is in some places obtainable by sinking wells into the lower layers. Irrigation then becomes possible and an oasis or fertile area is formed. Such an oasis is thickly planted with palms in the shade of which cereals, pulses and fruits are grown. There are many natural oases scattered through the great deserts. Camels are the characteristic animals of these hot deserts (cp. land transport).

IV. Temperate Desert Regions.

As Mongolia and Tibet have similar physical and climatic conditions they may be classed together. They are both high plateaux enclosed on all sides by lofty mountains and have in consequence a dry, extreme climate. A severe winter alternates with a short tropical summer. The rainfall is remarkably deficient—less than fifteen inches per year—and the temperature in summer is very high.

Such conditions cannot allow much vegetation and they are almost desert areas. There is, indeed, a big desert in the south of Mongolia and the rest of this region is a poor steppe or scrub land. A little cultivation is, however, done under great difficulty in places where water may be obtained from streams which

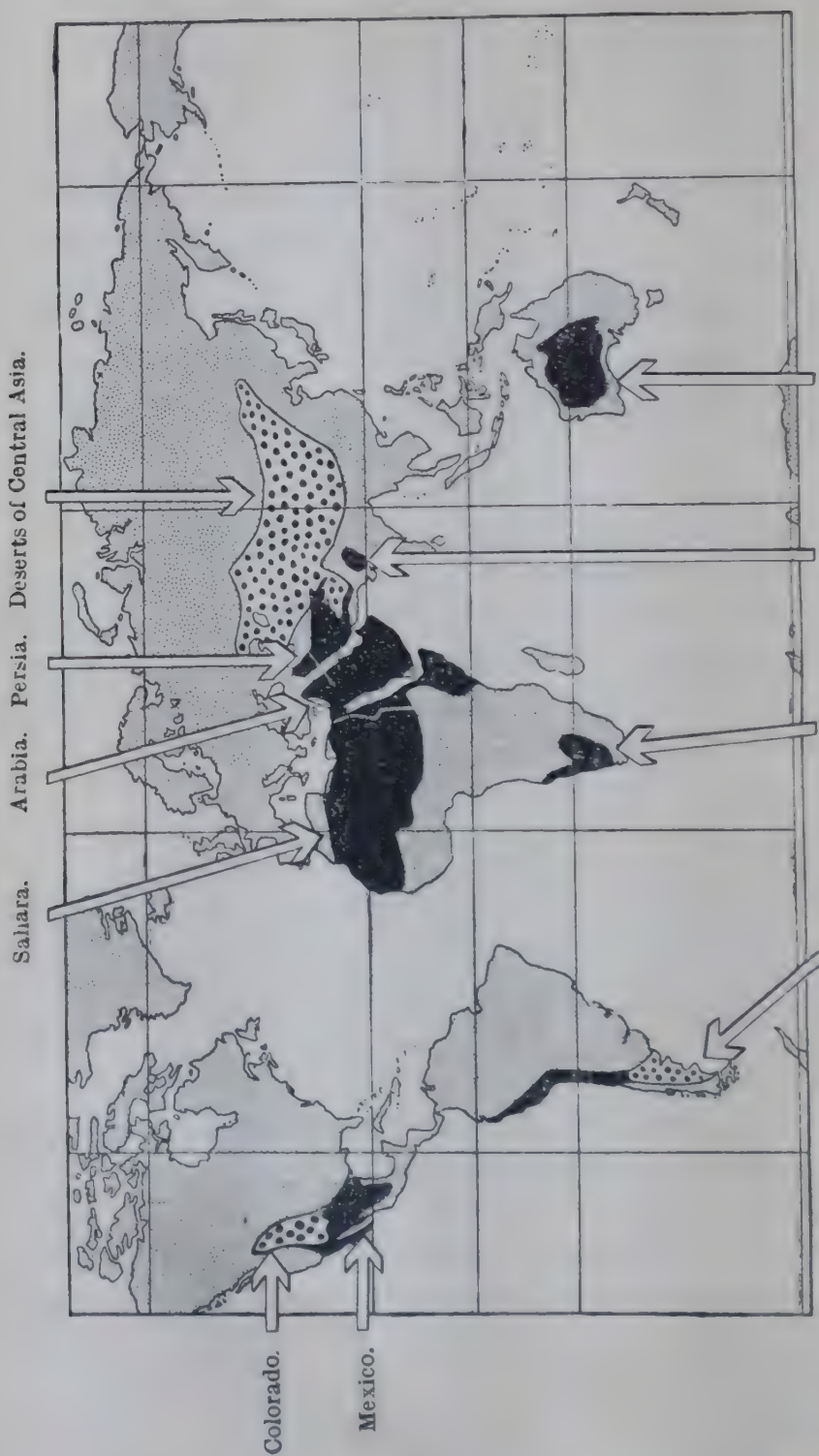

FIG. 19. MAP OF THE WORLD, SHOWING THE HOT AND TEMPERATE DESERTS.

rise in the high mountains of the north. Tibet resembles northern Mongolia in many respects, but the plateau is much higher. It is the highest plateau in the world. Here too, only a little cultivation can be carried on. The chief domestic animals are sheep, camels, horses, cattle and goats, but the animal commonly used in carrying goods over the Himalayan passes is the yak. What the reindeer is to the tundra people the yak is to the Tibetans. Like the reindeer it also supplies them with food and clothing and is the chief transport animal.

Similar plateaux are also found in the Andes of South America and in the Cordilleras of North America. The climatic conditions of the Peru-Bolivian plateau are not so extreme as in Tibet, for this Andean plateau is situated nearer the equator and in a comparatively narrow continent. As in Tibet the rainfall is small, with the result that trees are rare, and there is hardly any vegetation other than grass. Hence here, too, pastoral pursuits are the chief occupation of the people. Cattle and sheep as well as llamas, alpacas and vicunas are the chief animals reared. The wool of these animals is used for making clothing. Mining of silver, copper and tin, is also an important industry.

In the plateau of Ecuador climatic conditions are more equable and congenial than in those of Peru and Bolivia, for it is nearer to the equator. Pastoral pursuits remain an important occupation of the people but temperate fruits, vegetables and cereals are also grown wherever gardens and fields can be irrigated.

In North America the Cordillera or Rocky mountain system in its broader parts contains high plateaux between the ranges. In temperate British Columbia the dry intermontane plateaux are chiefly used in

rearing sheep and cattle, though in some places where irrigation has been possible fruits and cereals are grown. Just as in most of the other plateaux, mining is an important industry here. In U. S. A. the largest intermontane plateau is called the Great Basin. The rearing of sheep and mining are the chief occupations of the people of this arid semi-desert region.

The Mexican plateau is the most important in the southern part of North America. At an elevation of about 8,000 feet above the level of the sea the climate is suitable for human habitation; the volcanic soil is rich and water is obtainable from the snows and rains which fall on the neighbouring mountains. Wheat, maize, cotton, beans and temperate fruits are largely grown, and it is rich enough to support a large population.

The Iberian plateau, like all other enclosed plateaux, possesses an extreme climate; it is very hot in summer and cold in winter. Rearing of sheep and cattle as well as mining are the chief occupations of the people of this place as in all such places in other parts of the world. The Iberian plateau is often considered as part of the Mediterranean region. It differs from typical Mediterranean lands in having a slightly more extreme type of climate.

V. Warm Temperate Regions.

Some reference has already been made to the south-eastern part of the United States and the greater part of China, which have a climate similar to that of monsoon and tropical regions, except that it is cooler. In the Southern Hemisphere, the south-eastern coasts of Australia, the greater part of Natal in South Africa

and parts of the Paraguay Basin in South America are similar in climate.

VI. Mediterranean or Winter Rain Regions.

The lands bordering the Mediterranean Sea are marked off by their climate to constitute a distinct region. They have warm summers, mild winters and rains during winter. The year is thus divided into two parts—a dry, hot summer and a mild, wet winter. These climatic conditions have a remarkable effect on vegetation. As a general rule, rain is most needed by plants during summer when the land is warm. As the summer is dry, the plants of this region require to possess certain peculiarities, and such is the case. Some of them have long roots which strike deep into the soil in their search for water and very thick leaves which store up water. Moreover the trees are small so that the leaves are in the lower, damper layers of the atmosphere where they cannot lose so much water by evaporation. Plants with bulbs, tubers, root-stocks which store up water are very common. Had they no such protective devices they would not have been able to withstand the dry summer. Another characteristic of the vegetation of this region is that it is evergreen, but the leaves are small and have very thick skins. The chestnut and the walnut are the chief trees of the higher and wetter parts, and evergreen oaks of various species of the drier parts.

Among the trees of this region the edible chestnut and the cork oak deserve attention. The edible chestnut in some parts of the region is a staple food both for men and beasts, especially during the winter months. The chestnuts are ground into flour of which bread and a kind of porridge is made. The cork oak has a covering of thick bark called cork. The bark is stripped off

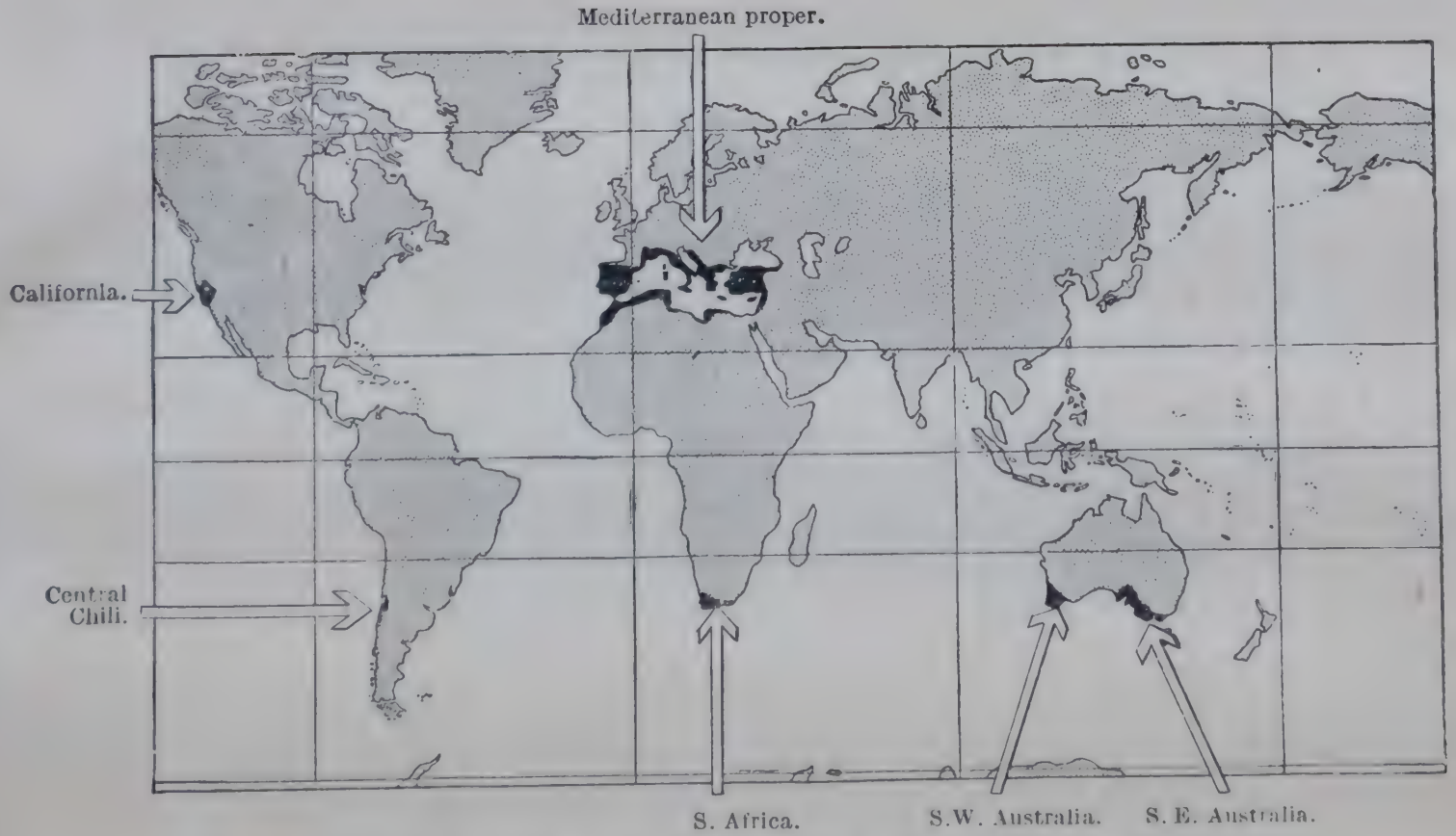

FIG. 20. MAP OF THE WORLD, SHOWING THE MEDITERRANEAN REGIONS.

the tree for the first time when it is about 20 years old, and afterwards the bark is taken off every ten years. It is cut into corks for bottles and the small waste pieces are used in packing grapes and other fruits into boxes.

Many of the Mediterranean plants, *e.g.*, the olive, fig, mulberry, orange, apricot were originally natives of Asia. The most important plant of this region is the vine which yields grapes, and the Mediterranean lands are noted for their manufacture of wine. France leads in this industry. The dried grapes are known by the names of raisins, sultanas and currants, the last being the smallest variety. Another important plant is the mulberry upon the leaves of which the silk worm flourishes. This is the reason why silk-worm rearing is an important industry in southern Europe. France, Italy, and Spain not only produce raw silk in huge quantities but they also occupy a very prominent place among the silk manufacturing countries of the world. The chief agricultural crops are wheat, maize, tobacco, and cotton. Rice is produced only in the valley of the Po, where the climate is not typically Mediterranean.

Lands similar to those round the Mediterranean Sea in both climate and products are found in the west of the United States in California, in the west of South America—in Chile, in the West of Cape Colony, in South Africa, in the South-West of Western Australia, and in the South of South Australia and Victoria. All of these places have almost similar products.

VII. Temperate Grassland Regions.

The interiors of all large continents have somewhat similar climatic conditions. Being far removed

from the sea they are almost beyond the influence of moist winds. They get a small amount of rain during spring. The summers are hot and the winters are cold—in some places almost unbearably so. In the grasslands of South Africa, South America and Australia the winters are not so severe as in the larger land masses of the Northern Hemisphere. In these interior regions trees are not found in large numbers, because there is not enough moisture in the ground for their proper growth. Scanty rains allow only grass to grow. In Eurasia such grassy lands are called steppes. In South America they are called pampas. In North America they are known as prairies, in Australia as Downs and in Africa as the High Veld or Grass Veld.

The temperate grasslands are thus scattered over the world and in somewhat different latitudes. Their aridity generally increases with distance from the sea. In Central Asia in the neighbourhood of the Caspian and Aral seas there are lands which are little better than deserts. A great portion of this grassy region is known as the Khirgiz Steppe. The chief occupation of the people of the grass lands is cattle rearing, sheep rearing and agriculture. They supply the people of a great part of the world with cheese, butter and other dairy produce as well as meat, tallows, hides and other animal products. Agriculture was formerly despised by the people of the steppe lands. But with the growing need of the world for huge quantities of wheat, the temperate grasslands have gradually become the great granaries of the world. Enormous quantities of wheat are grown in Canada, U. S. A., Argentine and Russia.

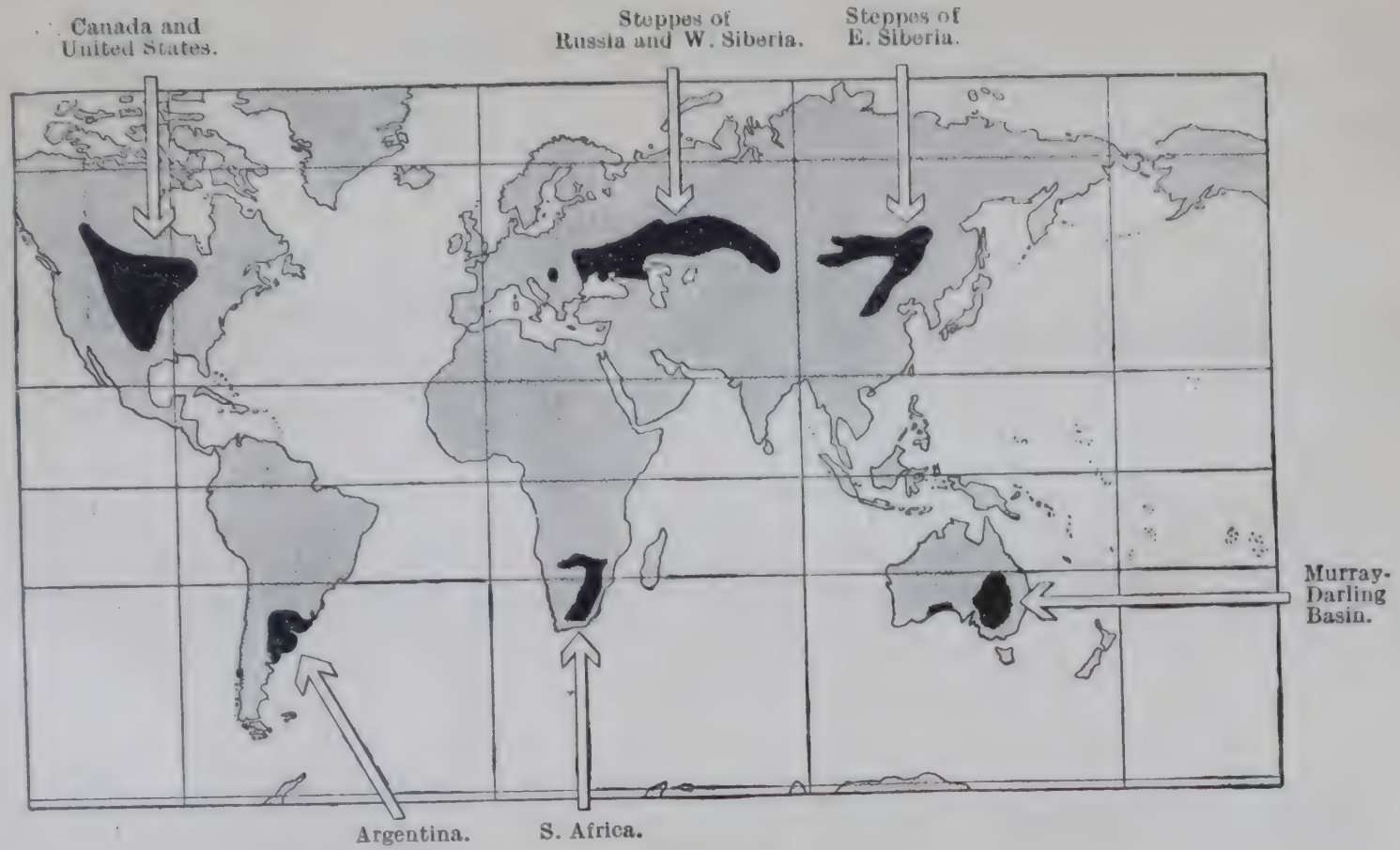

FIG. 21. MAP OF THE WORLD, SHOWING THE TEMPERATE GRASSLANDS.

In some parts of the prairies of North America cattle are still reared and large quantities of preserved meat are exported annually. On the grassy downs of Australia and New Zealand sheep are very important. Australian wool and mutton as well as Canterbury lamb (from Canterbury, New Zealand) are known all over the world. In South Africa large flocks of sheep and goats are reared and wool forms one of the important exports of the country.

The nature of their occupations made the people of the grasslands nomadic in habit. They wandered from place to place in search of fresh pastures for their animals. The Steppe people of Asia were remarkable in this that even their utensils are made of leather. During winter they made rude houses of reeds and other available materials and some of them lived in tents. But with the substitution of agriculture for pastoral pursuits the habits of the grassland people have changed enormously.

VIII. Temperate Oceanic Regions.

Western Europe and the western coasts of North America from Alaska to the Columbia river in the United States present in a marked degree similar climatic elements and are therefore taken together. In these places the summers are cool, the winters warm and rain occurs at all seasons. The rainfall is generally greatest where the land is highest, but nowhere is it insufficient for cultivation. British Columbia in North America may fittingly be compared with Scandinavia in Western Europe. Both are mountainous lands lying in the track of warm, moist, westerly winds. In both places high mountains drive the rain-bearing winds upwards to higher regions where

the moisture is condensed either into rain or snow. The slopes of these mountains get abundant rain and their summits are covered with snow. The lands on the leesides of the mountains are dry and have a somewhat wider range of temperature. The coasts in both places are broken into fiords and in both fishing and forest industries are more important than agriculture. Almost similar climatic conditions prevail largely in the British Isles, France (except the south-east), and over a great portion of Germany. The climate of these places tends to become more extreme as one proceeds eastwards from the coast, but it is nowhere continental.

This combination of moderate heat and plenty of moisture must have given rise to forests. In fact, the whole of Western Europe was originally covered with forests like those still remaining in parts of the British Isles (*e.g.*, the New Forest). They were forests of trees with broad leaves which became leafless in the winter. But at present, in most places, the original forest has been cleared and cultivation has taken its place. In low lands agriculture is the principal occupation, except on the coal fields where manufactures predominate. Cereals are the chief crops. Potatoes and sugar-beet are also largely grown. Sheep are kept on hill pastures and cattle on the richer grass lands where dairy-farming is quite an important industry. In the Southern Hemisphere the densely wooded south-west of Chile, the Falkland islands, Tasmania and New Zealand have almost similar climatic features and so similar products.

The deciduous temperate forests yield hard timber which is so valuable for furniture. They require much more heat and moisture than the conifers. The chief trees of this group are the walnut, oak, chestnut,

maple, beech and poplar in the Northern Hemisphere and the eucalyptus or gums in the Southern Hemisphere (Australia). The notable trees of the Australian forests are the blue gums, jarrah and karri. In New Zealand, Kauri pine is the chief timber.

The broad-leaved trees occupy the forest areas of Central and Western Europe, stretching from the foot of the Ural Mountains to the Cantabrian regions in Spain and across the North Sea and the English Channel to the British Isles. They occupy nearly the whole of the forest areas of the Japanese Empire including Korea. In all these regions, however, they are interrupted by tracts of coniferous forest on the mountains and other cold parts.

In North America they extend over large areas in the north-eastern part of the U. S. A. (New England States) and in South America in Southern Chile, Falkland and other neighbouring islands. In Australasia they extend over parts of New South Wales, Victoria, Tasmania and the Dominion of New Zealand. In Australia, however, the character of the forests is altered by the prevalence of the gum-trees, with blue green leaves set edge-wise to the sky.

IX. Temperate Eastern Margins of the Continents.

Eastern Canada in North America and Manchuria and Amuria in Asia possess similar climatic conditions and may conveniently be grouped together. They are all on the eastern sea-board of the cool temperate lands and get moderate rains at all seasons but chiefly in summer. The summer temperature is fairly high, but the winter is bitterly cold. The rivers and harbours remain ice-bound in winter except in the

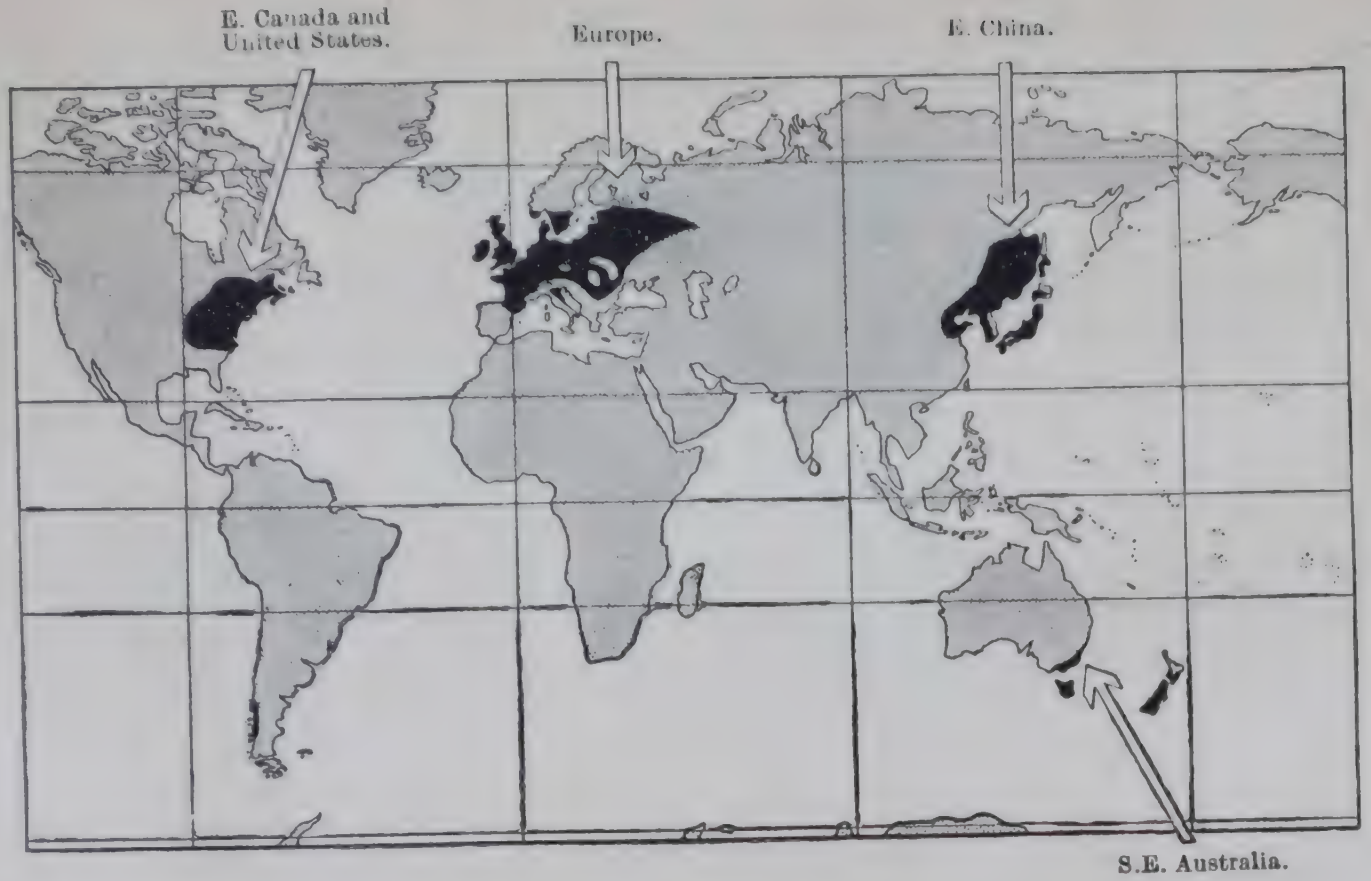

FIG. 22. MAP OF THE WORLD, SHOWING THE TEMPERATE DECIDUOUS FORESTS AND TEMPERATE EASTERN MARGINS OF THE CONTINENTS.

south. Vladivostok, the eastern outlet of Manchuria, suffers as a port in the same way as Montreal, the outlet of the St. Lawrence basin.

The rainfall is rather heavy along the coasts and this has given rise to forests which yield valuable timber. It decreases as one approaches the interior and the forest belt gradually passes into steppe lands (known as prairies in America). Eastern Canada is the most advanced of these lands and Amuria the least. The forests in America consist of a mixture of evergreen and deciduous trees, but the forest and woodlands have been cleared away over large areas. In the clearings of the forest agriculture, fruit growing, and dairy farming are carried on. The forests of Amuria are, as yet, unworked. They are the home of certain wandering tribes who live by hunting. Manchuria is a little more advanced. Its fertile plains and valleys are cultivated by Chinese farmers.

X. Cold Temperate Regions.

In the south the tundra gradually passes into woodlands and tall forest. The trees of these temperate forests fall into two divisions or groups. One set is evergreen and the other sheds its leaves in autumn and winter, receiving a new supply in the next spring. The first set is called Coniferous and the second Deciduous. We have already dealt with the Temperate Deciduous Forests which lie on the damper western margins of the continents.

Conifers grow fairly near to the tundra and on the mountain sides and high plains in the interior, where the winters are severe, the summer short and the rainfall rather scanty. At first it may seem astonishing to find forests in these regions of scanty rainfall. The

FIG. 23. MAP OF THE WORLD, SHOWING THE CONIFEROUS FORESTS.

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reason for the growth of the forest is that in these high latitudes evaporation is slower and less than in hotter regions. Hence it requires less rainfall to keep the subsoil moist. Besides, the needles of the coniferous trees give off their moisture very slowly, and therefore less moisture is demanded for the growth of a forest of these trees. The trees are tall and straight and so yield long, straight lengths of timber. Pine, fir, larch, hemlock and spruce are the noteworthy trees of the forest. They yield soft but durable timber and are therefore in great demand for joinery and building work.

The coniferous belt lies south of the Tundra in Eurasia and the barren lands in North America. Conifers cover the greater portion of Siberia, the northern portion of Russia and the western parts of Scandinavia, except the south-eastern portion of Sweden which is covered by deciduous trees. They also occupy the whole of the forest region of Canada and, strangely enough, the western margins of British Columbia and the United States of America, where the rainfall and the temperature would ordinarily give rise to deciduous or broad-leaved forests. The coniferous trees are here, however, somewhat different in character.

XI. Cold Desert or Tundra Regions.

In the extreme north of the Northern Hemisphere in the neighbourhood of the Arctic Circle and within it there are lands with cool summers, very cold winters and small rainfall at all seasons. These lands are generally high in the south and low in the north so that the slope is towards the north, *i.e.*, away from the sun. The low northern portion remains covered

with ice for about nine months in the year. The higher southern portions are, however, forested with stunted trees and pass gradually into the northern forests. Only during the short summer does the snow disappear and the ground thaw for a few inches beneath the surface. The water cannot sink into the hard ground and the surface is therefore soft and marshy. Only a few bushes, mosses, lichens, with some beautiful flowering plants, grow there. In the extreme north even this poor vegetation does not exist and the ground is covered with perpetual snow. Such a region of snow and ice with very little vegetation is known by the name of the Tundra in Asia and Europe, but in America the Tundra is known as the 'Barren Lands.' The Tundra is often called "cold desert" to distinguish it from the region of barren lands (hot deserts) within the tropics.

It will be evident from what has been said that such a barren region cannot support a large population and the animals of this region, too, must be somewhat peculiar. The most important animal of the Tundra proper is the reindeer. Cold cannot affect this animal. It can move with unerring foot over glacier, through morass or amongst boulders. It digs with its forefeet for the moss that lies under the snow and lives upon it. It is the chief transport animal, and upon it the people depend for their supply of milk and meat. When dead it supplies bones and horns for implements, tendons and sinews for thread and skins for leather. Other animals of the region are lemmings and the Arctic fox.

The people of this region have been compelled by nature to be hunters, fishermen, or stock-raisers. Lapps and Finns live in Norway and Russia,

Ostyaks, Yurahs, Samoyedes, Yakuts and Funguses and other small tribes in Siberia. A few Indian tribes are seen in the barren lands of North America, where the Esquimaux are the chief.

Like all hunters, the Tundra peoples are nomadic in habit. They are constantly on the move in search of moss for their reindeer or fish, upon which some tribes depend for their living. In summer they dwell in tents, but in winter they take shelter in half-subterranean huts of earth or in dwellings made of turf and sticks or even of blocks of snow.

XII. Mountain Regions.

The chief mountains of the world form a distinct region by themselves, although they show many varieties of climate, vegetation and products. It has already been seen in connection with temperature and altitude that in every ascent of 300 ft., temperature falls by one degree Fahrenheit. If we climb a mountain near the equator we may reach in succession places with a hot, moist climate; a warm, moist climate, a cool climate and an arctic climate. The ascent of the Himalayas from the low plains of Northern India or the ascent of the Alps from the northern plains of Italy, would give a vivid idea of the varieties of climate and changes in vegetation and products. At the foot of the Himalayas lie the hot, moist, fever-ridden, Terai jungles. When this dangerous region has been passed, we should come in succession to temperate forests, deciduous at lower and coniferous at higher levels, to mountain pasture lands and finally to regions of perpetual snow and ice.

Though communication in this region is difficult and at higher levels the air becomes so thin as to make even breathing difficult, yet people manage to exist here. On the mountain pastures (*e.g.* Alps), cattle and sheep are reared in summer, and the more advanced people of these regions have made much progress in manufactures and pastoral pursuits. The Swiss of the Alps not only make butter, cheese and condensed milk, but they have also made considerable progress in manufactures with their great resources of water power (from rapids and falls). Besides their native crafts in wood, leather and metal, they have made great porgress in the making of clocks, watches, cotton embroidery, silk goods and other articles which require small quantities of raw materials but much skilled labour. In other mountainous countries similar habits and occupations are noticeable. The Pyrenees, the Caucasus, the Himalayas and other Central Asian mountains, the Andes, the Rockies and other important mountains offer similar types of life—the lumbermen and hunters of the forests, the shepherds of the pasture lands and farmers of the narrow sheltered valleys.

The extreme difficulty of communication has had a remarkable effect upon the habits and character of the mountain people. Very often the people living in one valley are completely cut off from the people living in a neighbouring valley, though the distance between them may not be more than a few miles. This isolation has given a distinct character to the people of each of these valleys. Often they speak a different dialect and have a different social system from their nearest neighbours. But despite these differences they all resemble one another in one aspect. The difficulty with which they earn their scanty living has made them all hardy, daring, warlike and fond of

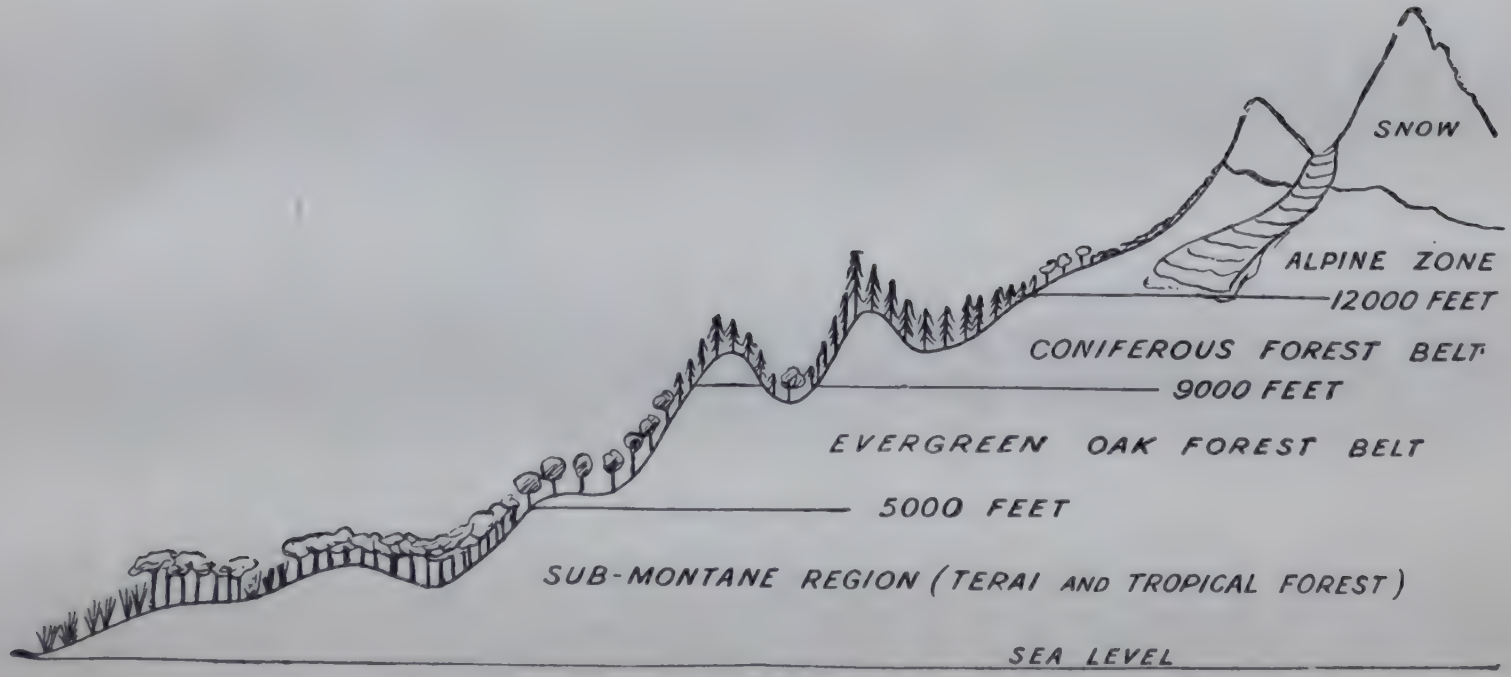
SNOW
ALPINE ZONE
12000 FEET
CONIFEROUS FOREST BELT
9000 FEET
EVERGREEN OAK FOREST BELT
5000 FEET
SUB-MONTANE REGION (TERAI AND TROPICAL FOREST)
SEA LEVEL

FIG. 24.

independence. The Swiss of the Alps, the Highlanders of Scotland, the Gurkhas of the Himalayas —they all show a remarkable warlike spirit of independence, quite uncommon in the people of the plains. Another thing to be remembered here is that the difficulty of communication has also rendered the few mountain passes extremely important. The comparatively low passes in the Alps and the Rockies are now crossed by several transcontinental railway lines and many important towns have sprung up at the entrances to passes. In many places tunnels have been made to avoid scaling the heights of the pass itself. But even now the high Himalayan and Andean passes are used only by such animals as the yak and llama, and the difficulties of transport are very great (compare **transport by land**).

We have now noticed how the world may be divided in twelve broad divisions. These climatic or regional divisions can never be complete, nor are they intended to be so, for the world is too diversified to admit of rigid classifications. The main object of this classification is to imprint some principal facts of world geography on the mind, at the outset, lest the mind should become perplexed with details. It shows the control of climate over vegetation and animal life.

CHAPTER III.

Commodities of Commerce.

Though the standard of comfort and modes of living are quite different in different parts of the world, yet all people want some food and drink to satisfy their hunger and quench their thirst and some sort of clothing to cover their nakedness. The food varies mainly with climate. Animal food is essential in cold places and vegetable food in hot ones. A mixed diet would, perhaps, be suitable to most persons all over the world. The Eskimo of the cold tundra would suffer terribly if he did not consume a sufficient quantity of warming animal fat, whereas the Negro of tropical Africa would suffer equally if he indulged in the same amount.

With regard to clothing too, climate is the determining factor. The people of the cold countries must have woollen clothing or some sort of thick material to keep them warm. On the other hand people of the warm parts must have some sort of thin clothing of cotton or other vegetable fibres.

As necessity has been the mother of invention in all ages, we find that the manufacture of calicos, muslins and other cotton goods began in the tropical and subtropical parts of Asia and that of woollen materials in the temperate parts of Europe.

The standard of comfort, however, is now the most important thing in the selection of food as well as of clothing. Some less advanced people in the tropics would be quite content with a piece of cloth wrapped round their loins, whereas other people in the same region would not be satisfied even with

silk, fine linen and cotton suits, but would require in addition thin woollens for winter use. Similarly, a poor man may be quite happy with pulses and bread as his food, while his rich and cultured neighbour will not be satisfied even with bread, sugar, butter and cheese, but must have meat, fresh milk, fruits, vegetables, eggs and many other things. So we may say, human wants vary with climate, but the standard of comfort depends mainly on the civilisation attained. The food of an average civilised man must include—

(a) Cereals, usually as bread,
(b) Fats, either animal or vegetable (oil or butter),
(c) Fruits and vegetables,
(d) Animal food or meat and eggs.

WHEAT.

The most important food stuff in temperate parts of the world is bread. Bread is generally made of wheat, though in some parts of the world rye, oats and millets are used. Rye is the staple food of the Russians and millet of the Indian except those living in areas of heavy rainfall. In the wet plains of India rice is the chief food. All these food grains do not grow in the same areas. They require widely different climatic conditions and soils for successful growth.

Wheat is the chief food grain of the white races all over the globe. It has special characteristics of its own. Different varieties exist adapted to varying local conditions, and so wheat can be grown in different places and with different seasons. Speaking broadly, it is a product of the temperate zone. Wheat is a grass first and then a grain : so it requires moisture first and then heat ; moisture is needed for the luxuriant growth of the grass and a dry sunny season

for the growth and ripening of the grain. It prefers a wet spring followed by a fairly hot summer, with a shower or two just at the time when the grain is being formed. The soil should be sufficiently stiff to support the plant's roots and stem and to retain moisture. Wheat cannot bear extremes of climate. The damp heat of the tropics is as unsuitable to it as the dry Arctic cold. The black soil of Southern Russia which can retain moisture for a very long time is well suited to its luxuriant growth.

The range of the growth of wheat is very wide, for it requires moderate temperature and moderate rainfall. The lower limit for the germination of wheat may be taken as between 40° and 41° F. It can thrive on a small amount of rainfall. 10 inches for instance in Mediterranean climates or on northerly grasslands (as in Canada), with a slight increase on the southerly grasslands (*e.g.* United States of America) will do well. It is obvious, therefore, that with proper selection of seed and proper methods of cultivation, cultivation of wheat may be extended over the whole of the semi-arid area of Canada in Alberta and Saskatchewan, and westward up to the foot of the Rocky Mountains in the United States of America. It may even be grown within the tropics if the elevation is sufficient to render the climate temperate, or if it can be adjusted to the climate. In India the seed is sown towards the end of the wet season, the plants grow and the grain ripens during the sunny, cool season, before the great heat of the hot season commences.

Wide range and different seasons of harvest ensure a steady supply which has a salutary influence on the price of wheat. Though Great Britain has to depend on foreign lands for about two-thirds of its wheat supply,

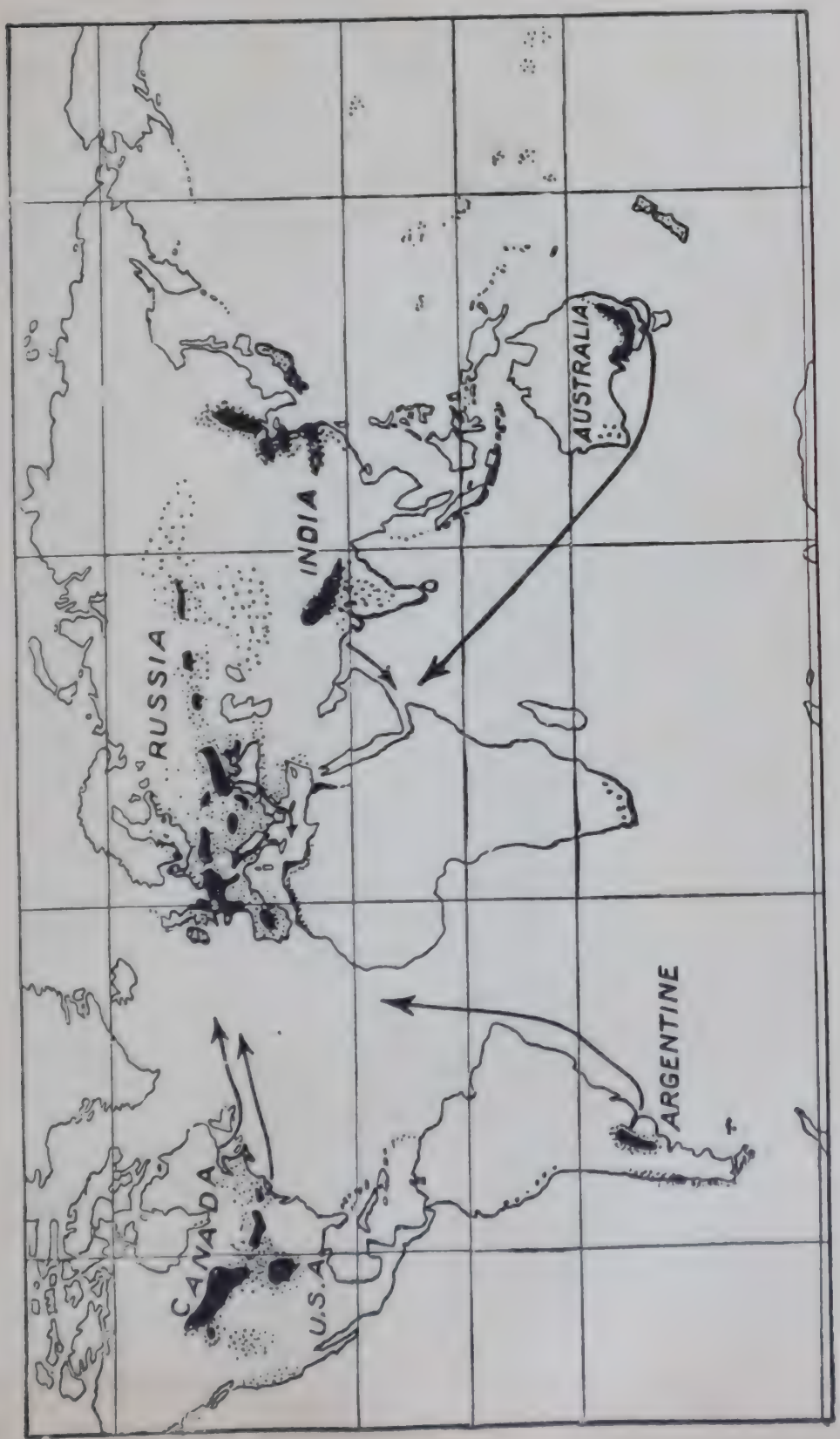

FIG. 25. WHEATLANDS OF THE WORLD.

it seldom suffers from violent fluctuations in its price. The Argentinian harvest as well as that of other countries in the Southern Hemisphere is in the months of November, December, and January: the Indian harvest is in January, February and March; the Canadian in July, August and September; the Siberian in September and October.

The great producers of wheat are, in order of importance, United States of America, Canada, India, Russia, Argentine, Australia, France, Great Britain, Rumania and Italy. These countries differ from one another in many respects yet they all satisfy the essential conditions for the production of wheat on a commercial scale. They all have large dry plains suitable for cultivation. Some of them have made rapid progress in scientific cultivation, while others are still continuing old fashioned methods of ploughing, sowing and reaping. In England, France and the United States of America, scientific tillage—including mechanical ploughing, sowing and reaping and the fertilising of the ground—is the usual rule and the yield per acre is high. Denmark produces forty-two bushels to the acre, while Russia and India only produce ten or eleven per acre, but still Denmark cannot compete with either in the export trade. This is because both in Russia and India, the land is cheap and abundant and so also is labour, while in Denmark both land and labour are expensive. This is just the difference between extensive cultivation and intensive cultivation. Moreover the Indians and the Russians grow wheat for export, their main food being rye in Russia and rice and millet in India.

The wheat belt in Russia is in the south between the Carpathians and the Southern Urals. The most fertile areas are along the Don and the Dneiper.

Photo. Govt. of Canada, Immigration Dept.

FIG. 26. THE WHEATLANDS OF CANADA. HARVEST TIME ON THE PRAIRIES.

Photo. Australian Govt. Immigration Dept.

FIG. 27. MECHANICAL REAPING OF WHEAT.

By Courtesy of the Canadian Pacific Railway.

FIG. 28. A WHEAT FARM IN CANADA. REAPING BY HORSES.

Both these rivers are navigable and there are good ports at or near their mouths. The chief wheat ports are Odessa, Nicolaiev, Kherson, Taganrog and Rostov and they are, respectively, near the Dneister, on the Bug, the Dneiper and the last two near the mouth of the Don. The small yield per acre must be due to the low intelligence of the farmer, and the poverty of the cultivating class, for the black soil of Russia is

Photo. Canadian National Railways

FIG. 29. A WHEAT ELEVATOR ON THE CANADIAN NATIONAL RAILWAYS.

one of the richest in the world. With increase of knowledge of modern methods of cultivation Russian farmers will produce more, and so we may expect an increase in export in future years.

The chief wheat areas in India are in the Punjab, North-West Provinces, the United Provinces and the Central Provinces. The areas in the Punjab and

North-West Provinces are far away from the sea, and have a dry climate whilst the irrigation facilities afforded by the tributaries of the River Indus are excellent.

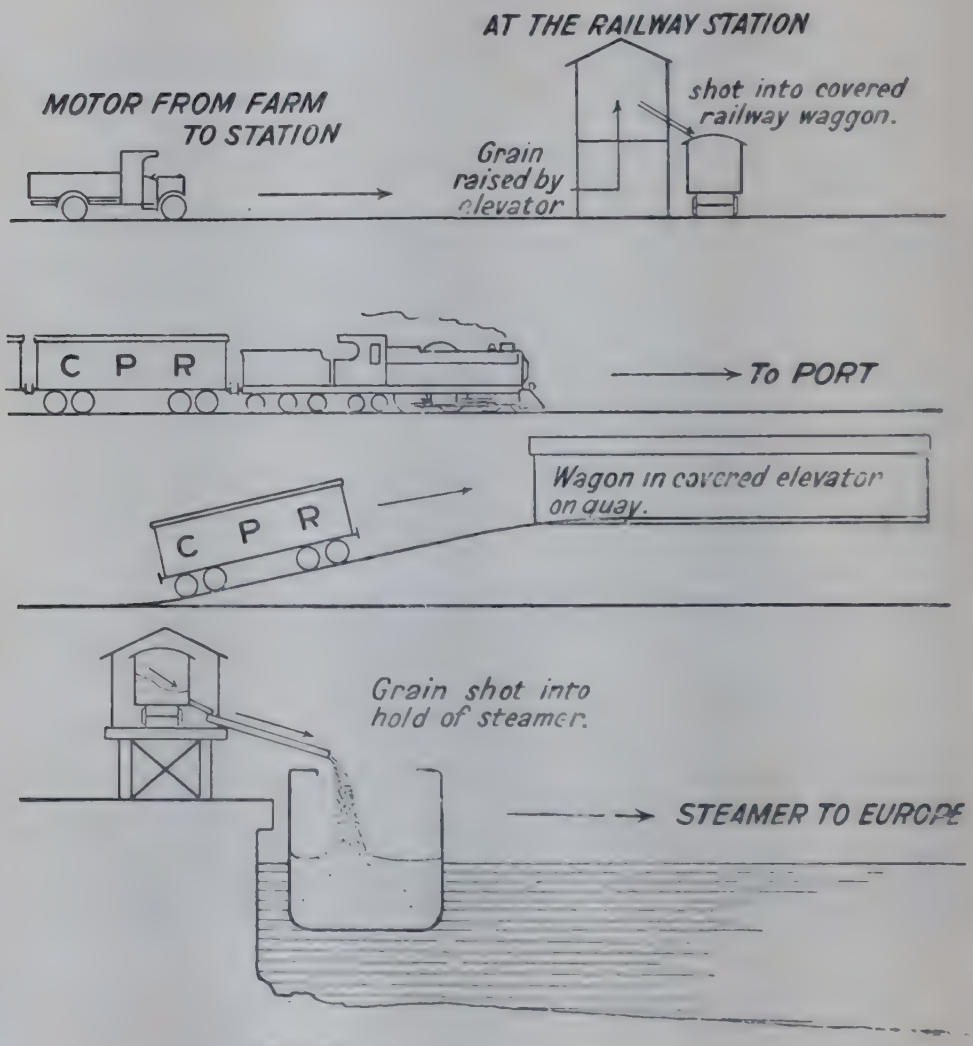
AT THE RAILWAY STATION
MOTOR FROM FARM TO STATION
shot into covered railway waggon.
Grain raised by elevator
C P R
To PORT
Wagon in covered elevator on quay.
C P R
Grain shot into hold of steamer.
STEAMER TO EUROPE

FIG. 30. DIAGRAM SHOWING THE USE OF ELEVATORS AND THE METHODS OF 'BULK-HANDLING' OF GRAIN.

The transport question has been solved by the extension and improvement of the Karachi line. Karachi, near the Delta of the Indus, deals with the produce of this region and is the largest

wheat exporting port in India. The United Provinces are far away from the sea and the Central Provinces are sufficiently sheltered by the Western Ghats to have the requisite climate. The sticky soils of the Tapti basin guarantee moisture; there is facility for transport especially by railways and labour is cheap. Bombay generally deals with the wheat of these regions. Cheap labour makes up for the distance of the Indian wheatlands from the European markets.

The important wheat growers in the Americas are Canada, U. S. A. and Argentina. The American soil is comparatively virgin, and it has been enriched for ages with the ashes of prairie fires and with the decayed bones of beasts and birds. Here the farmers have very large areas of land and they can therefore, profitably employ machinery, both for ploughing and reaping. Both the St. Lawrence and the Mississippi are navigable very nearly to their sources. There are also canals, lakes and railways so that both the Canadian and United States farmers have ample facilities for cheap transport. The huge quantities of wheat are now handled in bulk by the railways, every station having its grain elevator.

The chief wheat growing areas in Canada are Manitoba, Alberta and Saskatchewan, and those in the United States of America extend from North Dakota to Kansas. Wheat is also grown in California between the Sierra Nevada and the Coast Range and in the basin of the Columbia in Washington. New York is the most important wheat port in the States, but Baltimore, Philadelphia and Boston do a large trade on the east coast. The chief ports on the Pacific coasts are San Francisco and Oakland and on the lakes Duluth and Chicago. The Chief Canadian

ports are Port Arthur on Superior and Quebec and Montreal on the St. Lawrence.

The wheat area in Argentina is not far from the sea, but the required dry climate is insured, because the Plate basin lies in the track of westerly winds which have already deposited most of their moisture on the western sides of the Andes in Chile. The climate of this region is good and the land is so level that the construction of a great network of railways has been easy and transport is cheap. Buenos Aires, the chief port of Argentina, is joined by rail to Valparaiso, the great Chilean port, *via* Mendoza. Cheap land, good climate and easy facility for transport are attracting emigrants from Europe. They are chiefly Italians and Spaniards: the number of British emigrants is small. The rapidly increasing production of wheat from this region is not, therefore, surprising. The Germans do a large trade with this country and as an exporter it has surpassed India, which only a few years ago used to export more wheat than Argentina. The chief exporters of wheat in order of their position in 1925 were Canada, United States of America, Argentina, Australia and India.

RICE.

Important food grains, other than wheat, are rice, millet, maize, rye and oats. Rice is the staple crop of the Monsoon lands and the staple food of their people. It requires high temperature and heavy rainfall and prefers alluvial soil. As during a certain period of its growth it requires to be under water, it is obvious that it must be grown on level ground from which the water will not run off. Swampy lands near the sea and the deltas of rivers in tropical

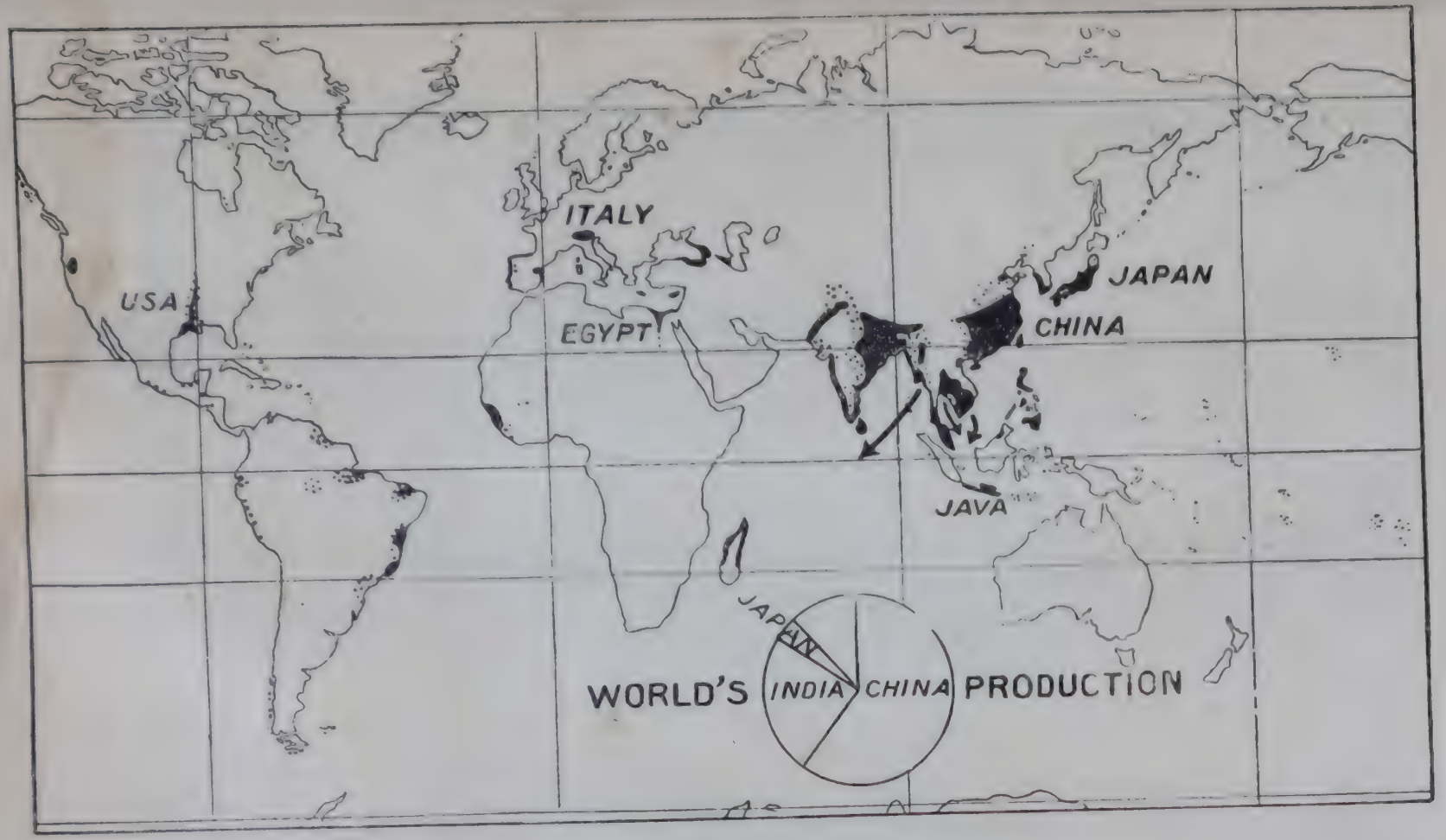

FIG. 31. THE RICE LANDS OF THE WORLD.

Photo by D. A. Ahuja, Rangoon.

FIG. 32. PLOUGHING RICE LANDS IN THE IRRAWADDY DELTA BY BULLOCK PLOUGH.
(*From Stamp's 'A First Geography of Burma.'*)

countries are most suited to it. It is grown in South-East Asia, Japan, East Indies and other tropical islands in the Pacific. In Europe it is produced in the low plains of Lombardy, *i.e.*, in the

Photo. L. D. Stamp.

Fig. 33. Paddy terracing on the hillsides in Java. Notice the Volcano in the background.

delta of the Po, in Italy; in North America it is grown in the south-eastern states of the United States of America; in Central America it is grown on low coastal lands; in South America on the coastal plains

of Brazil and Guiana, and the Lower Amazon Basin; in Africa in the delta of the Nile, along the Guinea coast, and, to a small extent, in Natal.

In India and China, where the largest quantities are grown, all the rice is required to feed the dense population. It is only in Burma, Siam and Indo-China that there is a surplus available for export. The great rice-exporting ports are Rangoon in Burma, Bangkok in Siam and Saigon in Indo-China.

MAIZE.

Maize, like rice, requires much heat and moisture, but less of both. It requires, however, more heat and rain than wheat. It prefers a fairly high summer temperature and plenty of rain and is essentially a product of the sub-tropical belts. It is grown on a huge scale in the United States of America and is still the main cereal crop of that country. In many countries it is mainly grown for animals but is still the staple food in many parts of South Africa, parts of Mexico, Romania and in some hilly parts of India. Cornflour or maize-meal is the chief form in which it appears as an article of food. In the United States of America it is eaten as "hominy" or "hone".

The United States of America lead the world both in the production and export of maize. The chief centres in the States are Cincinnati, Indianapolis, Chicago and St. Louis. At present nearly five-sevenths of the world's output is produced by the United States of America. Much of this maize is consumed locally and in connection with it a large pork trade has developed in those cities, the pigs being fed on the maize stalks and the grain itself. Argentina is

the second largest producer and before the Great War the world's chief exporter, but only produces five per cent. of the world's crop.

The Union of South Africa is now looming large in the export of maize. As a native of tropical plateaux, maize is not sensitive either to temperature or altitude, and South Africa offers the climatic conditions which are essential for its growth. The maize belt in this country is in the land lying east of 26°E and between 25 and 30°S latitude. The best areas are in the north-east of the Orange Free State and in the south-east of the Transvaal. The principal cattle ranches are in the same region and so maize has, as in the United States of America, the advantage of a local demand. With its advantage of favourable climate, easy facility for transport by rail to and shipment through the ports of Cape Town, Port Elizabeth, East London and Durban, South Africa may soon become the third largest exporter of maize in the world. It already occupies the fourth place, after Rumania. The other large producers are Brazil, Egypt, India, Mexico, Italy, Yugo Slavia and Hungary. Britain imports the grain mainly from the United States of America, Argentina, Canada and Rumania.

BARLEY.

The other cereals of the temperate latitudes besides wheat are barley, rye and oats. Barley is grown in nearly the same regions as wheat, and may be grown under similar climatic conditions, but it can withstand more cold and may be grown in poorer and more arid soil. It has, therefore, a wider range of cultivation than wheat. Sometime ago it was largely used for making bread, but now wheat is gradually

taking its place. It is still the staple food in North Africa, but it is now mainly used in the brewing and distilling industries for the manufacture of beer and whisky. Russia was formerly the largest producer of barley and about one-third of the total production of the world once came from Russia. The production of Russia has dropped enormously owing to war and revolution, and the leading producer in 1922 was the United States. Other important producers are India, Japan, Germany, Spain, Canada, the United Kingdom, China and Hungary. The exporters are Russia, Rumania, Canada and the United States.

RYE.

Rye is generally cultivated in regions where the climate is too cold or damp for the production of wheat, for which it is a substitute in the greater part of Russia, Germany, Poland and other countries of Central Europe. Rye-bread is the staple food of the poorer people throughout the north-east of Europe. Rye has a wide range, and can be produced in the wheat areas as well. It is very prolific and may be grown in very poor soil and under most inclement weather conditions. In Europe it is grown further to the north and east than wheat, because it requires less heat and can stand greater cold. In the north of America it is less grown than wheat, because there is not much demand for rye bread. For the same reason very little rye is grown in the Southern Hemisphere. Russia is the largest producer. The other important producers are Germany, Poland, Czecho-Slovakia, Hungary, Austria, France, Canada and the United States.

OATS.

Oats may be grown in almost the same regions as rye, but not in quite such poor soils. Oats are characteristic of damper and cooler regions than wheat. Rye is chiefly used for the making of the "black bread," and is chiefly used by the people in Eastern Europe, whereas oats are not only used as food but are also largely employed, like maize, in feeding animals. Consequently oats are much more in demand than rye and are cultivated in countries such as Canada and Scotland where there is little demand for rye. As oats are widely used as food for animals, the United States of America, the largest dealer in animal products, especially pork and beef, produce more oats than any other country in the world. The other large producers of oats are Russia, Germany, Canada, France, Poland and the United Kingdom (Scotland more than England).

MEAT.

After milk and bread the next article of daily consumption to be considered is meat. The pastures of all countries support cattle which meet local demand to a greater or less extent. Before the process of freezing meat to preserve it was known, most of the trade was in live cattle. Now that the carcasses can be frozen and sent to Europe and other densely populated parts of the world in ships fitted with refrigerating chambers, the trade in live cattle for food purposes has practically disappeared, for carcasses occupy far less space and can, therefore, be sent at a far less cost than live cattle. Rapid increase of town population, increasing speed and facilities for ocean transport, and improved

methods of preservation, have been instrumental in directing the attention of the people to the great grass lands of the world. They are the chief sources of the supply of meat and other animal products. At present the great meat-producing countries are the Plate region of South America (Argentina and Uruguay), Australasia and the United States. In Europe, Germany and Denmark have made some progress in meat production.

In the United States of America cattle ranches are very large. They extend all over the huge rolling grass lands west of the Mississipi and as far as the foot of the Rocky Mountains. There the air is clear and bracing, the ground is firm and dry, the water supply is unfailing and there are wide stretches of open grassland. The sheep are reared in the high plains and the more mountainous States farther west, for sheep can feed on shorter grass and can bear a bleaker climate. They are kept more for the sake of their wool than for meat, and are widely distributed over the States.

A very large number of cattle are reared in Ohio, Indiana, Illinois, Wisconsin and Iowa, where grain (maize) so essential for feeding the cattle is also grown. Many cattle from the drier grasslands of the Western States are sent here to be fattened before killing. Transport facilities are afforded by rivers, canals and the Great Lakes. There is complete water communication between the Mississippi and the North Atlantic *via* the Great Lakes.

The Plate region (so called because of its situation round the estuary of La Plata River) consists of Argentina and Uruguay. Here the ranches vary in size, but are all large. There was a time when they were not closed and the cattle ran about freely, but

now they are fenced by stockades. The temperature is moderate and the soil produces the most nutritious grass, especially for cattle. The land is level and hence transport is easy and cheap. Labour is cheap and the European market is nearer to the South American stock-raiser than to the New Zealand farmer. In addition to the carcasses being sent in refrigerating chambers, the flesh is also exported in other forms—as jerked or dried beef, tinned beef and as various extracts. In particular the tongues of the animals are tinned. Some of the biggest factories are at Fray Bentos where Liebig's extract and Oxo are made and at Paysandu where the tongues are tinned. The harbours of Argentina, *viz.*, Buenos Aires, Rosario and Bahia Blanca were, until recently better than the harbour of Montevideo but the latter now has a very fine artificial harbour.

The New Zealand farmer has, on the other hand, a few advantages over his Argentinian rival. He is a better farmer and more careful than his fellow farmer in the Plate Basin.

The South American farmer concentrates his attention mainly on beef; the New Zealand farmer mainly on mutton. It is interesting to note that the sheep which furnish the best wool do not furnish the best meat. The New Zealand farmer has aimed at the production of the best quality meat and so New Zealand leads the world in the export of mutton. In most of the European countries large numbers of sheep and cattle are kept, but they are all required to supply local needs. We shall mention below the important dairy farming industries of Denmark, Holland and Switzerland.

Generally speaking, in the countries which produce both beef and mutton, the cattle thrive in the wetter regions where good grass is available, whilst the sheep are able to live in the drier part. Thus in England the cattle are mainly in the wetter west, the sheep in the drier east; in South Africa the cattle in the wetter east and the sheep in the drier west. In the Argentine the cattle are in the damper north-east, the sheep in the dry south. There are many other examples of the same sort.

By Courtesy of the Australian Immigration Bureau.

FIG. 34. A SHEEP FARM IN AUSTRALIA.

Pigs are kept in large numbers in China, the United States and in most of the countries of Europe. The fresh meat, known as pork, is the principal meat used by the Chinese. The flesh of the pig, when

dried and smoked, is known as bacon. Huge quantities of bacon are exported by the U. S. A., Denmark and Canada and consumed in various European countries. The pigs in the United States are kept mainly in the great maize regions and are fed partly on the maize stalks. The United States specialize in the production and export of lard which is made from the fat of pigs. Enormous quantities of pork are also tinned, especially at Chicago.

DAIRY PRODUCE.

Fresh milk is almost indispensable to children and for the sickly and aged. A constant, local supply is desirable, for milk becomes sour quickly and tends to serve as a breeding place for noxious germs. So we find dairy farming is often an important industry in the suburbs of large towns. The milk trade of a country is therefore largely free from foreign competition. But with regard to butter and cheese the case is quite different. International competition is very keen here. The countries with good natural grass lands are at an advantage in this direction. In Europe the most advanced countries in dairy farming are Denmark, Holland and Switzerland. The industry is very old there and the people have the necessary skill which centuries of practice have given them.

The Danish farmers are very careful in feeding and milking the cows. The Dutch and the Swiss are not far behind the Danes. The Swiss cheese and condensed milk are famous throughout the world. Britain every year imports large quantities of butter and cheese from these countries, but her supply from her colonies is on the increase from year to year. In fact Canada,

Australia and New Zealand are now the great rivals of Denmark, Holland and Switzerland in this trade.

New Zealand, New South Wales and Victoria send large quantities of butter to the United Kingdom and other densely populated countries in Europe and Asia. The rich soils, the development of large co-operative farms, and excellent railway and shipping facilities have combined to ensure success in this trade. The

N. Z. Government Publicity Photo.

FIG. 35. A DAIRY COW IN NEW ZEALAND.

same causes have encouraged the start of a condensed milk industry which is very likely to affect the Swiss industry in the near future.

The Provinces of Ontario and Quebec in Canada have made great extensive studies in dairy farming. These provinces have rich cattle pasture where the forests have been cleared and enjoy the facilities afforded by the Great Lakes and the St. Lawrence River for

transport. In addition they are in a favourable position on the east coast of North America, facing Europe. Unlike Victoria which specialises in butter, Ontario specialises in cheese. In increasing quantities of it is being sent every year to Great Britain.

FISH.

Almost everywhere in the world fish is an important constituent of food and people have been engaged in the catching of fish from very early times. Wherever there is water, fish are found, and fishing is an important occupation of the people all over the world. In many countries fishing as an occupation supports a considerable population. We shall here consider only the big fisheries of the world.

The chief fishing grounds of the world are (1) in the North Sea extending to Iceland and the northernmost point of Norway and around the British Isles; (2) in the north-west of the North Atlantic (around Newfoundland and Nova Scotia); (3) in the north-east of the North Pacific (coasts of British Columbia); (4) in the north-west of the North Pacific, around Japan. In all these places the sea is shallow and there are submarine banks, on which the fish can obtain their food and find suitable spawning grounds.

In the North Sea rich fishing areas are the Dogger and Hardinger banks. The Norwegians, the Scotch, the English and the Dutch are engaged in the fishery. Norway has all the necessary things for the fishing industry. Her fishing grounds are very prolific and they are very near to the fishermen's homes and her barren soil has forced the people to look to the sea for their food supply. Besides her forests give her abundance of soft timber for the making of packing boxes.

Her position in proximity to the densely populated parts of north-western Europe supplies her with necessary markets. The fishery industry in Norway also benefits from her broken coast line and good harbours. Bergen (Norway) and Billingsgate (London) are the chief fish markets for the North Sea fisheries. The most important catch in the warmer waters of the south are the herring, hake and pilchard, and in the cold water the chief catch is cod. Norway has a fishery in connection with each of them. The cod is caught on the submarine bank south west of Tromso on which the Lofoden islands stand. The water is cold, for it is within the arctic circle, and there is a kind of seaweed on which the cod can find their food. The cod are either split and dried on ' stakes ' or salted and dried on the cliffs. They are respectively known in the market as ' stock fish ' and ' klippfish.' There is also an important trade in connection with oil, and the cod liver oil is of much value for its medicinal properties. The herring are generally found in the warmer waters which separate the Stavenger and Hardinger banks from the floor of the North Sea.

The chief Scottish ports are Wick, Aberdeen and Peterhead and they do a very large trade. The fishermen go to sea and their wives and children stay in the coast villages or towns. It is interesting to note that in connection with the manufacture of sails and ropes a linen and jute industry has sprung up in several of the ports notably in Dundee. The important English fishing ports are London, Grimsby, Hull, Lowestoft and Yarmouth. Fisheries are really important all round the British shores; in shallow water the flat fish, plaice and sole are highly valued, whilst oysters are reared in the muddy estuary of the Thames.

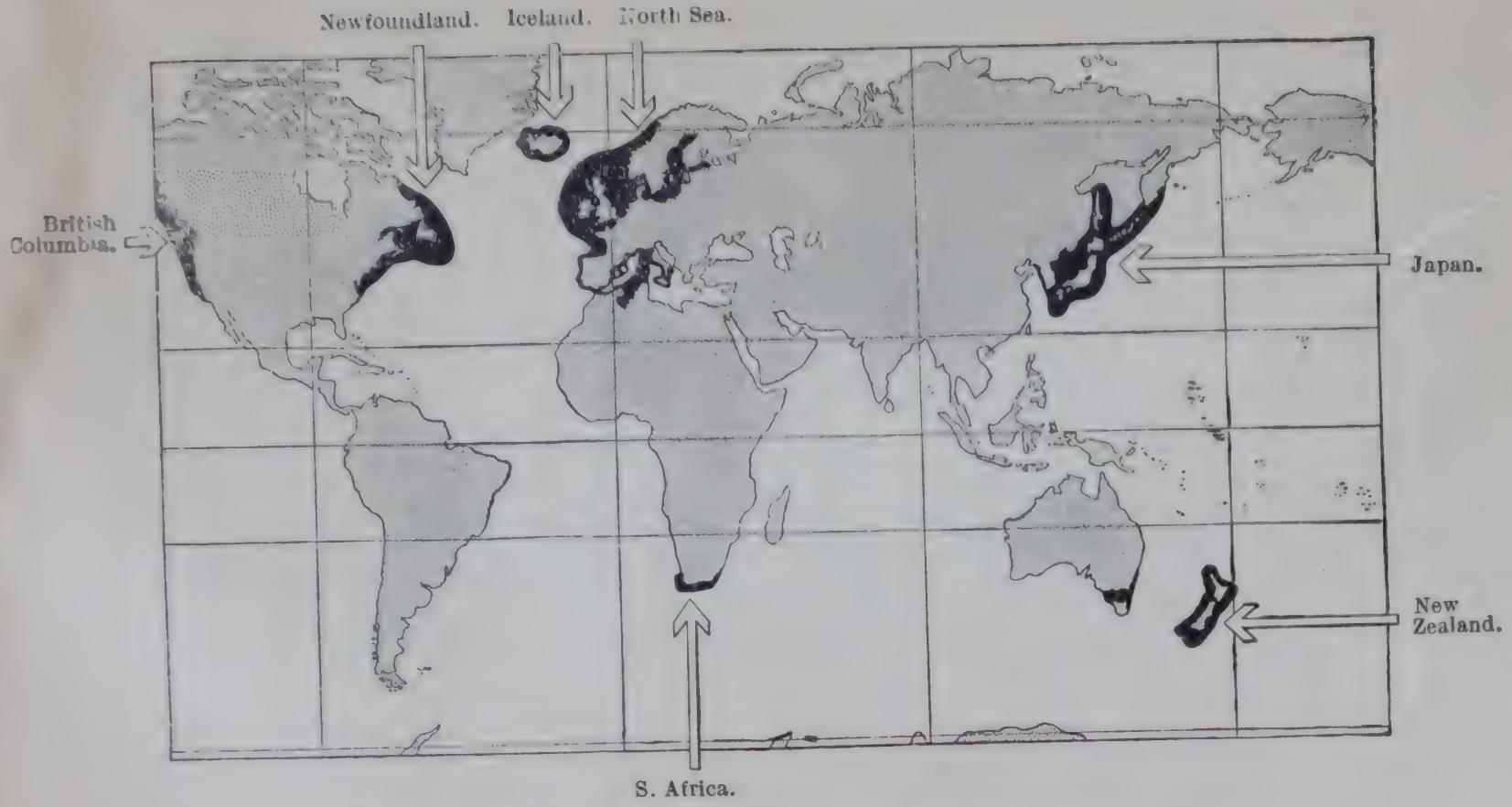

FIG. 36. MAP OF THE WORLD, SHOWING THE TEMPERATE FISHERIES.

In the north-west Atlantic the fishing grounds extend from the north-east of Newfoundland to Cape Hatteras in North Carolina. The Newfoundland banks are, however, the most important part of this area. The bank is caused by the dropping of huge pieces of stone and other materials brought down by the icebergs which melt by coming into the warmer waters of the Gulf Stream Drift. Here the chief catch is cod and St. John's is the centre of the cod fishery. There is also a herring fishery in the west of the bank between Miquelon and the shores of Fortune Bay. But the chief centre of the herring fishery is in the submarine channel off the Atlantic coast, especially in Chesapeake Bay. The chief ports are St. John on Fundy Bay, Portland in Maine and Gloucester in Massachusetts but market facilities favour Boston and Halifax. Oysters are also found in plenty in Chesapeake Bay and they are exported mainly from Baltimore and Norfolk. The other important catch are lobster, salmon and haddock.

In the north-east Pacific the Fraser and the Columbia rivers and the neighbouring seas are the chief areas of fishery in Canada and U. S. A. There is a canning industry at New Westminster and other places. The chief catch is salmon and the rivers are some times so full of them that it is said that one 'can walk across the Fraser on their backs.' The chief food fishery of the United States of America in the west is in the Columbia River and along the Alaskan shores. The cooking and canning of the salmon have become an important industry in the States of Washington and Oregon. In the Californian Gulf the water is warm and almost tideless and the fishery is mainly for pearls.

The fishing grounds in the north-west of the North Pacific extend all round the islands of the Japanese Empire and all along the shallow seas to the Yellow Sea and up the rivers that flow into this sea. Cold waters so essential for food fisheries is brought by cold currents that flow southward through the Bering Strait. The most prolific parts of this region are in the south and east of Korea and the Yellow Sea. Thousands of Chinese and Japanese are engaged in this industry. Dense population both in China and in Japan affords good markets for the catch. The Chinese are such voracious eaters of fish that they also import large quantities of fish from the warmer regions of the tropics.

The consumption of fish in the world at the present time is so huge and the fish are caught in such numbers, that it is feared the future supply may be endangered. This has led governments in many countries to adopt stringent laws regarding fishing. The object of these laws is to stop the killing of small fish and even that of big fish at the time when they lay eggs. The United States of America probably lead in this direction. Not only is the observance of fishing laws insisted upon there, but the United States government has also made successful experiments in the artificial propagation of fish. There thousands of people are busy in distributing and hatching many millions of eggs. It is by this method that the shad has been transferred from the east coast (in the Atlantic) to the Californian Coast (in the Pacific).

Besides the important fishing grounds we have just described, there are a few other centres of some importance. They are in the Sea of Azov ; near the mouth of Volga in the Caspian Sea ; along the shallow coasts of Cape Colony, Madagascar and Zanzibar. There

are also fishing grounds in the north of Australia and in the calm channel of the Great Barrier Reef. The shallow coasts of New Zealand also have important fisheries.

The fisheries on the African coast support a considerable population. The most important centre on this coast is Simon's Town. Mauritius alone imports thousands of pounds worth of fish from Simon's Town and other fishing stations on this Coast.

The most important catch at the mouth of the Volga is sturgeon from which caviare is made. It is more a luxury than a food fish. Though it is less nutritious than the oyster, yet it is much more in demand. Thousands of people are engaged in this fishery. Astrakhan at the mouth of the Volga is one of the greatest fish markets in the world. It sends its produce in almost every direction.

The New Zealand fishery is partly for shark. This fishery is very interesting because of the way in which everything is utilized most economically. The best portion of the flesh is used by the Maoris for food, the liver gives valuable oil and the fins are exported to China. The remaining portion of the fish is used as manure.

Pearl fisheries are important in the north of Australia where the water is warm and shallow; also along the Great Barrier Reef and on the broad continental shelf between the Exmouth and the Cambridge gulf. Of recent years the natural pearl industry has suffered from the competition of Japanese "cultured" pearls. The Japanese have discovered methods of encouraging the oysters to manufacture real pearls.

FRUITS.

Fruit constitutes an important item in a man's food. It is in demand in all parts of the world. It is more important as an article of commerce now than it was some time ago when the fruit-supply was either local or derived from a small distance only. Now-a-days increasing speed of steamers and the improvement in the art of preservation, both in canning and in cold storage, have widened the fruit markets. Half a century ago the sunny parts of Southern Europe supplied fruits to Europe. Great Britain had its supply of grapes, oranges and lemons from Spain, Portugal, Italy and other parts of Southern Europe and at times from North Africa. These with some apples, pears and plums from Northern Europe and Normandy made up the entire supplies of fresh fruits. In addition dried fruits, such as raisins, currants, dates and figs, were obtained from Southern Europe, North Africa, Egypt and Arabia (cp. Mediterranean regions).

Now, for reasons already noticed, the fruit markets are very extensive though the main supply of temperate fruits is from countries with the Mediterranean type of climate. Great Britain and the other populous parts of western and central Europe get fresh fruits from the United States, (especially California), Canada, West Indies, New Zealand, Tasmania and several other parts of Australia, the Union of South Africa, Ceylon and a few parts of India.

For descriptive purposes fruits may be classified into several groups :—

I. Temperate Fruits.

1. **Citrus Fruits**—oranges, lemons and grapefruit, characteristic of the Mediterranean climate. The fruit trees are evergreen.

2. **Deciduous Fruits**—that is the fruits of trees which lose their leaves in winter. Apples, pears, plums and cherries are characteristic of the temperate Oceanic regions; peaches, apricots, almonds, figs, of warmer regions.

3. **The Vine**—essentially Mediterranean.

II. Tropical Fruits.

Bananas, pineapples, mangoes, etc.

In no country has the growing, preserving and exporting of fruits reached such a perfection as in the United States. There are vast areas in the western lands of the United States of America as well as in Carolina and Florida under fruit. California is now one of the greatest fruit-growers of the world, and perhaps would have been the greatest, if the water supply of the western part of United States of America had been better.

Almost every kind of Mediterranean fruit, *viz.*, grapes, oranges, lemons, grapefruit, apples, pears, peaches and apricots, is found in California. Thousands of hands are engaged in this trade; some are engaged in the gathering and packing of fruits and others in the drying and canning of them. California has a big local market as well as a large market reached by railway in the densely populated parts of the United States of America itself, and there is a demand for the Californian fruits in almost every quarter of the world. The vine flourishes in California and huge quantities of the dried raisins are exported.

Western Australia, South Australia, Victoria and Tasmania in Australia are looming large as growers and exporters of fruits. In

Western and Southern Australia and Victoria the cultivation of the vine is very largely carried on and the wines made there are well-known throughout Australasia. The oranges of Western Australia have already acquired a status in the world's markets. In Victoria fruits of all kinds thrive weli and especial care is devoted to the growing of varieties suitable for drying, canning and exporting. In Tasmania the growing and preserving of fruits for export are industries increasing in importance from day to day and the fruit industry is now one of the most important in the island.

The other parts of Australasia are no less important. In New Zealand, the production and exportation of fruits have recently made rapid progress. The Auckland districts are specially suited to the cultivation of oranges and lemons. Besides them, peaches, pears and apples are grown extensively and in some of the valleys subtropical fruits are also grown. Perhaps at no distant date New Zealand will play an important part in the fruit markets of the world. Queensland, in the tropical parts of the continent, can grow and send pineapples to Great Britain and other parts.

Among the British Colonies, Canada ranks high as a grower of fruits and has long been noted as the land of apples. Besides apples, peaches, pears and plums are grown and exported extensively especially from British Columbia. Acres after acres of land are found to be under the cultivation of fruits in the provinces of Nova Scotia, Ontario and British Columbia. The position of Canada is indeed the sixth among the exporters of fruits in the world.

South Africa, too, is beginning to be important as a fruit-exporter. Special attention is being given to

the production of grapes in the south-west, oranges in the south and pineapples in the south-east. South Africa takes also an important place among the manufacturers of wine and large quantities of it are consumed annually and some sent to Great Britain.

We have already observed that the countries bordering the Mediterranean Sea are large growers of temperate fruits, and that the important fruits of this region are grapes, lemons, figs, almonds and oranges. The vine as already noticed is the chief plant of this region. It is very widely cultivated in France, Spain, Italy, Portugal, Southern Germany, Hungary and Greece. In all these countries the grapes are converted into wines of various kinds. France is the best manufacturer of wine in the world. From the grapes of the Cote d'Or (the Golden Slope) are made the Burgundy wines of world repute; from the grapes of the Garonne basin claret is made; from the grapes grown in the valley of the Marne is made the famous Champagne. The wines made in the Iberian Peninsula include those known as Port and Sherry; the former comes from the districts round Oporto and Tarragona and the latter from the district near Jerez. The Italian wines include those called Chianti, Capri and Marsala, which are manufactured respectively in Tuscany, Naples and Sicily. France, Italy and Spain together produce more than three times as much wine as the rest of the world.

In addition to those used in wine-making some grapes are exported in a fresh state and the rest are dried into raisins and currants. Raisins are exported largely from Spain, Asia Minor and Turkey, and currants (made from very small grapes) from Greece and the Ionian Islands.

Lemons are largely exported from Sicily and Italy and figs from Turkey, Asia Minor, Italy and Greece. The exportation of figs is mainly from Turkey, Asia Minor, Italy and Greece, and that of oranges from Spain, Portugal, Italy and Malta.

Among tropical fruits bananas and pine-apples occupy an important position as articles of trade. They are grown abundantly in most tropical lands. Very little trouble and attention are required in their cultivation. The West Indies, tropical America and Africa, the Canary islands, and Northern Australia are the chief sources of supplies of bananas for commerce. Pine-apples are grown extensively in the Straits Settlements, the Azores, West Indies, Florida, and the Hawaiian Islands.

SUGAR.

Sugar is one of the most important foods. Even the poorest cannot now do without it, for it enters into the composition of various kinds of food. Ridiculous as it may now sound, a few centuries ago sugar was considered as an article of luxury, and even now among the poor people in the tropics it is considered more as an article of luxury than of necessity. All human beings must have a certain proportion of sugar, and so impure and raw kinds of it, such as molasses, were commonly used. "Jagri" is used in India; honey in some other countries. Almost every place in the tropics with plenty of moisture grows sugarcane and makes a rough quality of sugar for local use. About a century ago, sugarcane was the only material of which sugar was made. Now huge quantities of sugar are also made of sugar-beet and a little

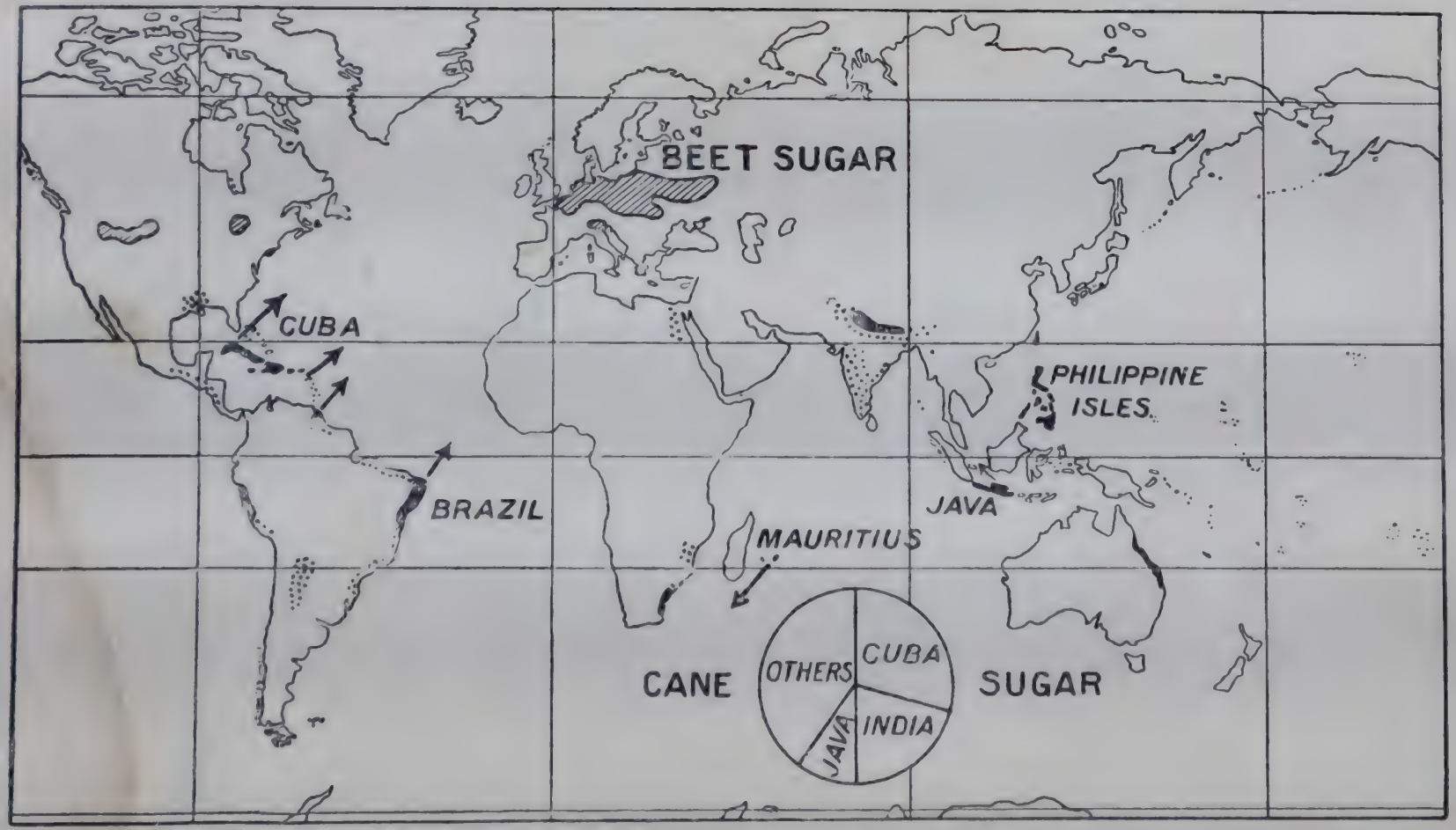

FIG. 37. THE SUGAR-GROWING COUNTRIES OF THE WORLD.

from the sugar-maple. At present the bulk of the sugar of commerce is made from the sugarcane or from sugar-beet, the former is essentially a tropical product and the latter temperate.

The sugarcane requires for its successful production a moist, well-drained soil together with a high temperature and heavy rains. It prefers sea breezes which may be almost essential for its healthy growth. A favourable site for its cultivation would, therefore, be low land in a tropical island. It is consequently natural that the West Indies, the East Indies and other islands in the tropics supply the largest quantities of cane sugar. Places in order of their supply of cane sugar are Cuba, India, Dutch East Indies, Brazil, Hawaii, Mauritius, Philippines, Dominica, British Guiana, West Indies, etc. India, although second on the list and producing a large quantity of cane sugar, also imports a huge quantity from the East Indies.

Sugar-beet is a product of the temperate zone and prefers a light soil. It is extensively grown in the poor soil of the Great European Plain. In normal times Russia has the largest acreage of land under its cultivation. Next in order of their importance are Germany, France, Czechoslovakia, United States, Holland and Hungary. Germany is now, however, the largest producer of beet-sugar.

Before the last Great European War manufacture of beet sugar increased so wonderfully and its price fell so much that many cane sugar manufacturers even in the West Indies had to stop the manufacture of sugar.

In fact, owing to the competition of cheap beet-sugar, some of the islands of the West Indies, which had sugar as one of their principal industries, had

almost to give it up. Before the last Great European War, Germany exported more sugar than all other countries put together, and even now she is a large manufacturer of beet sugar. The great prosperity of the German sugar industry before the War was principally caused by the bounty given by the Government over the export of sugar. Since the last War the artificial stimulus of a bounty has ceased to exist and the production of sugar has much diminished to the great relief of the manufacturer of sugar in tropical and semi-tropical latitudes. At present the import of sugar to India is chiefly from Java and Mauritius and is much greater than the export. Sugar is, indeed, one of the leading imports of India. Formerly India was a large exporter of cane sugar. The East India Company used to export this substance from India to England. They had their supplies mainly from Bengal. Unfortunately this industry has suffered so much since then that India is now a large importer instead of exporter of sugar. The decline in this industry is due to the competition of bounty-fed beet sugar of Central Europe, as just now observed and to the competition of Java and Mauritius which possess better soil for the growth of sugar cane and employ better methods of extracting juice from sugar-cane and of making sugar.

Indian sugar is obtained from sugar cane, and also to a large extent from the bastard date and palmyra palms. The chief product is crude sugar (gur or jagri) although in some parts a certain amount of fine sugar-making is carried on. "Jagri" is commonly used in the village, but in the town refined sugar is generally used. The taste of the people is now changing fast, and even in the village those who can afford it now use more sugar than gur or jagri. Hence re-

fined sugar is rapidly tending to push out the crude stuff formerly consumed by the people. It is perhaps on account of this change of taste that the important trade of India in sugar shows an increase generally from year to year. Fortunately in connection with the steady demand for fine sugar and partly as a result of the local supply of sugar-cane and cheap labour a few sugar factories of a modern type have been set up in recent years in Bihar and the United Provinces. The profits from this industry are small because of the cheapness of the foreign sugar. The sugar canes used in these factories yield a low percentage of juice, but the greatest difficulty is in obtaining a sufficiently large supply of canes to keep the machines constantly at work.

Sugar-cane may be grown everywhere within the tropics in the soil where rice may be grown. It is cultivated throughout India, and on a large scale in the United Provinces in Bengal and the Punjab. The areas in other Provinces are comparatively small. Sugar-cane cultivation has recently received an impetus in Burma owing to the favourable report of the Indian Sugar Committee whose members are of opinion that Burma has the possibility of being a large producer. Promising results were obtained in the Namayin Valley, Myitkyina District and small plot experiments at Hopin with Mauritius and other varieties yielded 40 tons of cane per acre. Sanction has been obtained for a small power crushing and boiling plant at Hopin, to be worked, first by Government and then, if found to pay, to be handed over to a Co-operative Society formed among growers of cane.

In the north of India and in Bengal 20 tons of sugar-cane per acre is considered a good crop, and the average outturn of gur is from $1\frac{1}{2}$ to 2 tons. In the

Deccan, where sugar-cane is mainly grown under well-irrigation, the average outturn of gur per acre varies from $2\frac{1}{2}$ to 3 tons.

The prospect of the sugar industry in India is not very gloomy. The present system of pressing out the juice by hand and making sugar in small quantities from the cane grown on small holdings is mainly responsible for the small outturn. If the place of poor cultivators is taken by Co-operative Companies or by rich capitalists who can use the large plantation system and use better machinery for extracting juice and making sugar, the industry is very likely to prosper, for there is a large steady demand at home.

TEA, COFFEE AND COCOA.

Besides wine the chief drinks commonly used in different parts of the world are tea, coffee and cocoa. The value of each as a stimulant is roughly the same. They all require a rich, light, friable soil and need frequent heavy rains, but a well-drained sub-soil. The plants must be sheltered from violent winds, and they are easily damaged by dampness at the roots. A favourable site would, therefore, be a clearing in a forest on the side of a hill exposed to trade-wind or monsoon rains They are, however, grown at various elevations, cocoa being grown in the low regions, coffee in the middle and tea in the higher regions. They all demand a great deal of cheap, skilled labour and therefore even if the soil and climate be suitable they cannot be grown unless the labour is available.

Tea is the dried young leaves of a small evergreen shrub; coffee is obtained from the roasted berries of a small tree whilst cocoa (and chocolate) are made

from the dried and roasted beans of a large, big-leafed evergreen tree known on the cacao tree.

Though they agree in so many respects yet they differ from one another very materially from the climatic point of view. Tea plants require a lower temperature and are grown at higher levels than either coffee or cocoa. Tea is essentially a sub-tropical product whereas coffee and cocoa are tropical products. The cacao or cocoa tree is even more tropical than the coffee. Tea plants are able even to withstand severe frost and therefore have a wide climatic range. The coffee plant has not as wide a climatic range as tea, for it is very sensitive to cold and to hot dry winds. The cocoa tree is more sensitive to exposure than the coffee. It is peculiarly sensitive to all kinds of winds, especially winds off salt-water and, therefore, the sheltered basins of the Orinoco are specially suitable to it. It also, unlike tea and coffee, prefers a volcanic soil. The cacao grows normally nearer to the equator than the coffee, and the coffee nearer than the tea.

Nearly all the tea of the world comes from China, Assam, Ceylon, Japan and Java. The tea shrub flourishes best on the hill sides of these lands and tea is a typical export of Monsoon Asia. The British Empire really controls the tea trade of the world now. The use of tea spread from China and it is said that its cultivation began in China more than 2,000 years B.C. Even now, China is the largest producer and consumer of tea but her position is only third as exporter, the first and second positions being respectively taken up by India and Ceylon. The other large exporters are Japan, Dutch East Indies and Formosa.

Assam and Bengal contain more than 5/7ths of the total area under tea in India. There are tea

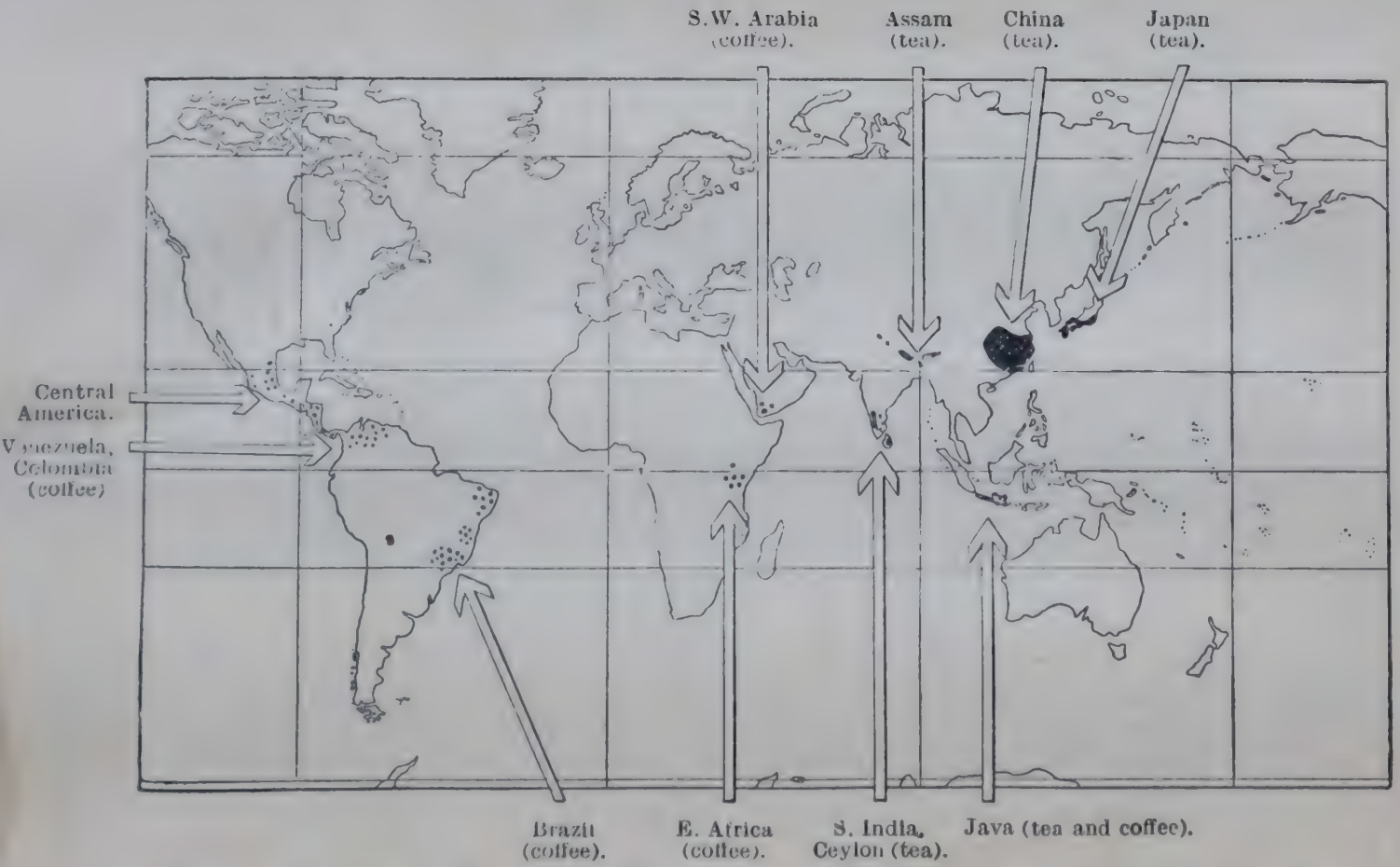

FIG. 38. MAP OF THE WORLD, SHOWING THE WET, HILLY TEA AND COFFEE REGIONS. THE TEA REGIONS ARE SHOWN IN BLACK; THE COFFEE REGIONS BY SMALL DOTS.

gardens on the slopes of the Nilgiri Hills in Southern India but in other places, *viz.*, Bihar and Orissa (Chota Nagpur), United Provinces, Punjab and Burma, the cultivation of tea is comparatively unimportant. The tea industry in India shows on the whole a steady progress, though there are slight rises and falls. The total production varies between 300 and 400 million pounds. Assam alone produces more than two-thirds of this total. The bulk of the production is exported, the export from India averaging over 300,000,000 lbs. The largest customers for Indian tea are the United Kingdom, Russia and France in Europe; the United States, Canada and Chile in America; Arabia, Ceylon, Persia and Turkey in Asia; Australia, New Zealand and the Fiji Islands in Australasia; Egypt and South Africa in Africa.

The tea area in Bengal and Assam coincides more or less with the area of maximum rainfall. The plantations are mainly along the sides of the hills, so that the slope of the land does not allow water to settle at the roots and spoil the young plants. The soil is fertilised by ages of decayed vegetation. The gardens are found on the southern slopes of the Khasi and Garo Hills (centre Sylhet), and on both sides of the Brahmaputra Valley, where the chief centres are Dibrugarh and Sibsagar, but the Valley of the Barak is becoming more and more important. The chief centre of this area is Silchar. It is served by a railway from Chittagong, one of the most important of the minor ports of India. The gardens in Assam yield more tea than the gardens in Northern Bengal on the slopes of the Himalayas, but the latter produce the first quality. The best known Himalayan gardens are in the neighbourhood of important sanitoriums and hill stations like Darjeeling.

Tea is also a staple crop in Ceylon. Little but tea is cultivated at a height of 2,500 feet and above. In Ceylon, too, as in India the area of tea coincides more or less with the area of maximum rainfall. The most important tea area is in the district between Kandy and Nuwara Eliya.

In the temperate monsoon area *i.e.*, in China, the tea is, unlike that of the tropical monsoon area *i.e.*, India, grown on small peasant holdings. The season is so short that there can be only two or three pickings. The labour is so cheap and the holdings so small that machinery does not usually pay. The main tea area is in the lower part of the Yangtse basin. The other important area is in the provinces along the south-east coast—Kwantung, Fukien and Chekiang. The necessary moisture is brought by the south-east monsoon during summer. The produce of this region finds an outlet through the various ports between the mouths of the Yang-tse-kiang and the Si-kiang,—Hangchow and Ningpo in the north and Swatow and Amoy in the south. The most important port of all is Fu-Chow. Other tea ports include Hankow and Canton.

Japan is next to China as an exporter of tea. The chief tea areas in Japan are in the centre and south. Kioto, the old capital, is the centre of the tea gardens and it is connected by rail with the adjacent ports of Osaka, Kobe and Yokohama. Taiwan (Formosa), is noted for the Oolong tea which is grown in the north and north-west of the island. Japan produces a "green tea" different in character from that of India or China, and exported mainly to the United States of America.

It has already been noticed that coffee is a tropical product, and the plant requires more heat and grows

to a greater height (15 to 20 feet) than the tea plant and has a smaller climatic range, for it is more sensitive to cold and to dry winds. It is of two kinds, high land and low land. The 'Arabian' highland kind is much finer but the 'Liberian' lowland kind is more prolific. As it is generally grown for export the best situation for a coffee plantation is a low mountain range in the tropics and near to the sea.

The best quality coffee is grown in Yemen in Arabia; along the sides of the 'Blue Mountains' in Jamaica and in Bolivia, but the output of coffee in these places is very small. At present South America controls the coffee markets of the world. The various Cordilleran States together come next to Brazil which alone supplies two-thirds of the world's demand. The most important coffee areas in Brazil are along the sea-ward slopes of the Serra do Mar. The chief ports of this region are Rio de Janeiro and Santos. The other large exporters of this article are Haiti, Dutch East Indies, Colombia, Venezuela, Guatemala, Mexico, India, Costa Rica and Nicaragua. It will be noticed that these are all Central American countries (except India and the Dutch East Indies) and 9/10ths of the worlds' coffee comes from Brazil and Central America. Coffee plantations in India are confined to the southern parts of the Deccan. The plantations have succeeded in Mysore, Coorg, Travancore and the Nilgiri hills of Madras. The industry failed entirely in Bengal. The area under coffee is showing an almost continuous decrease from year to year. It is reported that in some of the coffee-growing districts the coffee is making room for tea. The decline in this industry is due to the Brazilian supplies of cheap coffee in the markets of Europe and the consequent

fall in prices. The prevalence of disease in India was also a great trouble. Some coffee is also grown in the hills of the Shan States in Burma. As in Southern India, coffee planting was formerly much more important in Ceylon than it is now.

The chief customers for Indian coffee are France and the United Kingdom. The other customers are Australia, New Zealand, Asiatic Turkey, Arabia, Bahrein Islands and Ceylon. The average export of the five years from 1916-17 to 1921-22 was roughly 231,200 cwts. In 1925-26 the value was nearly 2 crores of rupees.

The cacao tree, like the coffee, has a long tap root which requires a deep alluvial soil preferably of volcanic material. It also requires great heat and moisture, much more heat than does coffee. It is more sensitive than the coffee to wind. A favourable situation for cacao plantations would therefore be a low alluvial plain of volcanic deposits in the tropics sufficiently sheltered from winds. We find it flourishing magnificently in the north of South America, in the volcanic valleys of Central America and in the Selva low lands of which it is probably a native. It is also extensively grown off the Guinea coasts in Africa, where the little islands of San Thome and Principe produce nearly as much as Brazil. There has been an extraordinarily rapid development in the production of cacao in recent years on the neighbouring parts of the main land. In 1913 the Gold Coast with a production of 50,000 tons occupied the first place as producer and in 1922 the Gold Coast produced a third of the world's supply. Other leading producers are Brazil, Ecuador, Nigeria, Trinidad and Venezuela—all of these countries lying in the Equatorial regions.

CLOTHING.

A desire to cover nakedness and to decorate the human body exists even among the savages of the tropical belts, though there is no necessity for protection from cold. As civilisation advances, so does the desire for more varied clothing. Now clothing is made either of vegetable fibres such as cotton and flax, or of the animal products, such as wool and silk.

COTTON.

Of the vegetable fibres cotton is by far the most important. It is probably a native of subtropical Asia, and two of the most important cotton products, Calico and Muslin take their names from Calicut and Mosul. Calicut is a port on the Malabar Coast in India and Mosul on the Tigris in Mesopotamia. Flax is probably a native of Southern Russia and even now Russia leads the world both in the production and export of flax.

Cotton thrives well in a light, well-drained soil in warm latitudes and prefers a sea breeze. It has a considerable climatic range, though it is sensitive to frost. It does well in warm, moist, even climates, where the summer is long and where there is salt in the soil or in the air. A relative humidity is more useful than the finest irrigation works; total amount of rainfall is of less importance than its seasonal distribution. Rain in late spring is essential to the development of stem and leaf. Sea breezes are beneficial for quality. So the ideal situation for a cotton plantation is on low lands near the sea, or preferably on islands, in tropical or semi-tropical latitudes. When it is grown inland the "wool" becomes shorter in

staple and it becomes more difficult to separate the seeds from the " wool."

The chief cotton producers are the United States of America, India, Egypt, China, Brazil, Sudan, Nyasaland and Uganda. It will be noticed that these countries have a monsoon, tropical or warm temperate oceanic climate.

The United States of America is far ahead of the other cotton producing countries in the world and in fact regulates the cotton market. The cotton grown in the States is of two principal kinds, sea-island and up-land. The sea-island cotton grows in the States of North Carolina, South Carolina, Georgia and the islands along their Coasts. As the marine climate is essential for quality the farther the cotton area is from the sea and the more continental the climate, the coarser is the output. The chief centres for the sea-island or long-staple cotton are Charleston and Savannah. The islands of Barbados, Cuba and other West Indian islands also produce a considerable amount of sea-island cotton. Probably the sea-island cotton was introduced into the United States of America from Barbados.

The ' upland cotton ' is grown in very large quantities in the Gulf States of Georgia, Alabama, Mississippi, Arkansas, Texas and Oklahoma. The cotton produced in these States is of shorter staple but the output is huge. The chief port in this region is New Orleans, on a bend of the Mississippi in the delta. The other cotton ports are Galveston and Mobile.

The cotton of the United States of America is mainly exported to England, France, Germany and the other cotton manufacturing areas in Europe. Japan also imports a very large quantity but America's

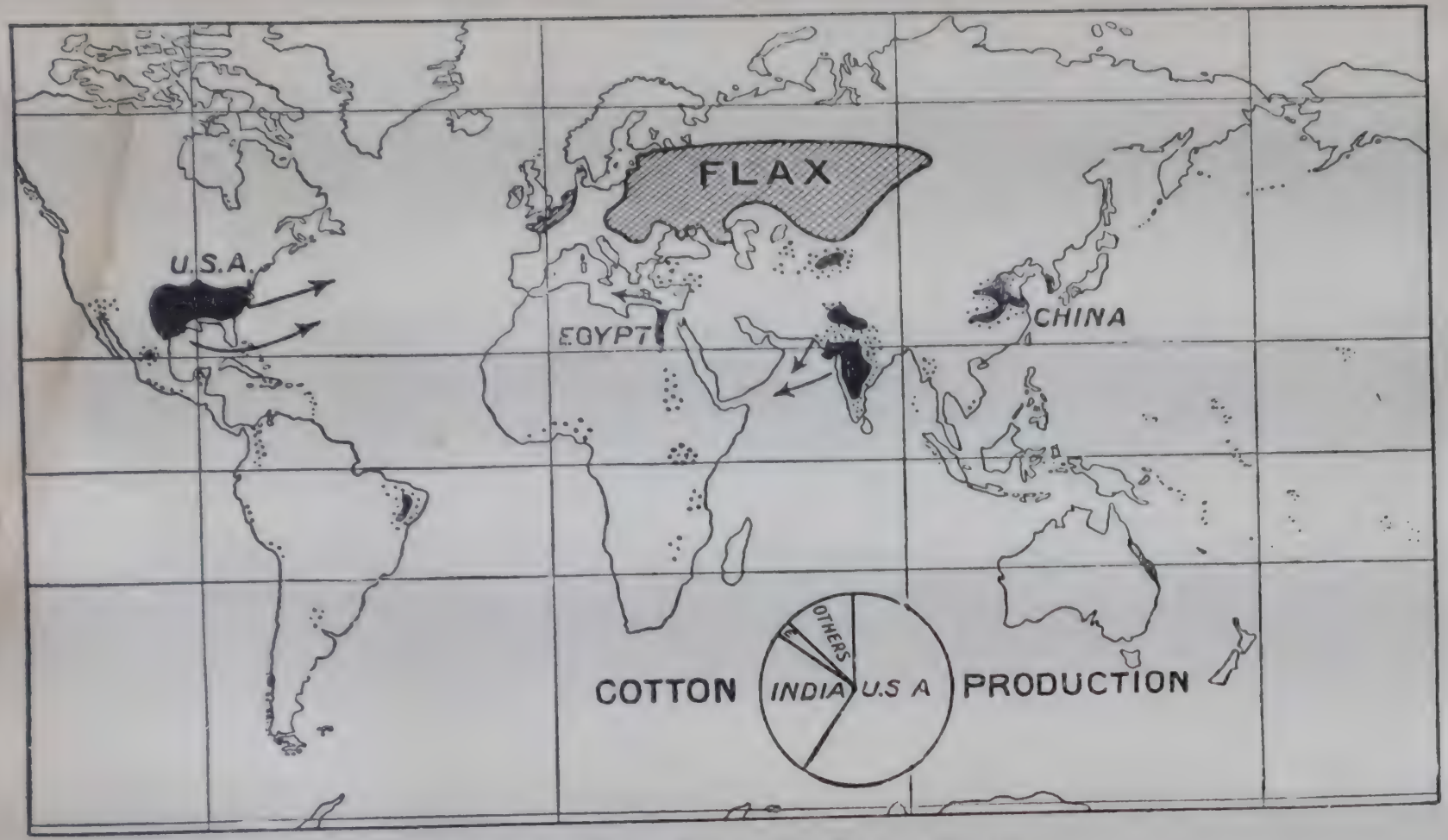

FIG. 39. COTTON AND FLAX LANDS OF THE WORLD.

greatest customer is Lancashire. Liverpool alone takes three-fifths of the exported cotton. It will be noticed later in connection with the influence of climate on manufacture how Manchester, with the ring of towns encircling it, is by far the most important cotton manufacturer in the world.

The United States of America is not only a producer of raw cotton, but she is a big manufacturer of cotton as well. The industry began in the New England States with humid climate, supply of suitable water and water power and coal in the neighbourhood. Many of the earliest settlers in these parts were weavers from England. The earliest centres were on the best falls at Lowell and Manchester, and they still maintain their positions, though they are a little away from the coal field. The other important towns are Fall River, Lawrence and New Bedford. The last town makes the finest calico in the States. As far as the nearness to coal fields is concerned the cotton towns of Baltimore, Patterson and Philadelphia are more conveniently situated and they also have probably the best market facilities. The cotton industry is now extending southward. In the south the greatest development has, however, been made in the Carolinas and Georgia where there are valuable coal fields and rich supplies of raw cotton. The people here have none of the historic advantages of the New Englander and they produce rather the coarser products which are sent for native use to Central and South America.

The native cotton produced in India is of short staple. In quality it is inferior to the cotton grown in the United States of America and Egypt but much larger quantities are grown than in the Nile basin. Most Indian cotton is of medium quality. It is grown

in the Punjab, in the valley of the Ganges and on the black-soil lands of Bombay. The short stapled Indian cotton suffers from excessive heat and from want of bright sunshine during the period of the south-west monsoon. Except for the American varieties grown on the irrigated lands of the Punjab the best Indian cotton is grown in the extreme south-east of the Deccan, *e.g.*, Madura and Tinivelli, because the rain fall is there from the north-east monsoon.

The chief centres of cotton in the Ganges valley are in the neighbourhood of Allahabad and Mirzapur. The cotton area in this valley has tended to decrease somewhat. The marine climate so desirable for the growth of the better varieties of cotton is absent here. The plants have to depend on rain brought by the Bay of Bengal branch of the south-west monsoon which is deflected westward by the Himalayan chain.

The industry in Bombay is thriving. The soil of the Narbada and Tapti Valleys and of the neighbouring plateau is of volcanic origin and is rich in plant-food. The sticky soil of this region retains moisture for a very long time and makes up thereby for the deficiency of rain to the east of the Ghats. The gaps of the rivers allow monsoon wind to blow inland and there is excellent facility for transport by rail to Bombay. The lands in the low Gujerat plains are especially suitable to cotton. The chief centres of the cotton manufacturing industries are Bombay and Surat. In fact, Indian cotton is known in the British market by the name "Surat." The best cotton of this region is, however, grown in Berar round Amraoti, Khamagon and Akola, all of which are on the main line from Bombay to Calcutta *via* Nagpur.

The cotton industry in India took advantage of the situation created by the Civil War in the United States

of America, when the cotton supply from the States was stopped altogether. The merchants of Lancashire, unable to get any supply from America, were compelled to fall back on Indian cotton and this gave a great stimulus to Indian cotton growers who extended its cultivation in order to supply the English demand. As soon as the Civil War in America came to an end and the supply from America became adequate and regular, the English merchants stopped buying Indian cotton. The manufacturers in Bombay found a considerable supply of raw cotton on their hands and began the manufacturing industry in earnest. Subsequently the partition of Bengal by Lord Curzon gave rise to what is commonly known as the Swadeshi movement, *i.e.*, a movement for the growth and fostering of indigenous goods. Preference shown to home-made cottons by consumers, especially in Bengal, gave a facility for markets beyond the dreams of many and it is no wonder that, with such a steady local demand, the industry is progressing.

The Bombay industry has now considerably affected the cotton industry in Lancashire but the former is now being affected almost in the same way by the cotton industry in Japan. Much of the prosperity of the city of Bombay is dependent upon the cotton industry. Ahmedabad, another cotton town in the plains of Gujerat owes its importance mainly to cottons.

Though almost all the important cotton mills of India are in Bombay yet there are two cotton mills in Bengal, the Banga Lakshmi Cotton Mills and the Kusthia Cotton Mill. Of the two the former is worthy of special attention. Almost every mill in India excepting the Banga Lakshmi Mill uses more or less foreign yarn. The produce of this mill is, no doubt,

coarse, yet every educated Bengali takes pride in patronising this mill.

On the irrigated lands of the Punjab the American varieties of long-stapled cottons grow, and large quantities are exported from Karachi.

The Egyptian cotton, as already noticed, is of long staple and is far superior to Indian cotton. It is probably inferior only to the sea-island cotton, but the total output is even less than that of India. It is grown in the Delta and Middle Egypt. Though the climate is continental and the rainfall insufficient except in the northern portion of the Delta, yet it is quite successfully grown. The deficiency of rainfall is made up by the excellent system of irrigation which supplies water all the year round and by the annual deposit of alluvium brought down by the Nile from the mountains of Abyssinia. It is grown between Alexandria and Assiut where irrigation works guarantee a perennial supply of water. The chief cotton ports in this region are Alexandria and Rosetta.

The Japanese cotton is inferior to Indian cotton and only coarse yarn may be spun from it. Moreover, the dense population in Japan demands that the available lands be devoted to the growing of food-grains. Hence as far as the growing of cotton is concerned India would have no serious competitor in Japan. The real cause of the fear of Indian growers is the establishment of a direct Japanese line from Kobe and Yokohama *via* the Tehuantepec railway to the cotton growing States of the United States of America.

The Japanese manufacturers have several advantages over their rivals in Bombay and Lancashire. The cotton mills in Japan work a longer period; more female labour is employed and a lower rate of wage is given even to male operatives; and there is besides

a good market very close to their doors in China. The Indian mill owners have, however, the advantages of a large home supply of cotton of medium quality and of a big home market for manufactured cotton. The Japanese cotton on the other hand is too coarse to yield fine yarn which is fit to be woven in power looms. Over the merchants in Manchester the Japanese have the advantage of having a portion of their raw material at home ; but the former have the advantage of cheaper coal. The Japanese with plenty of coarse hand-spun cotton are, however, growing to be the serious rivals of the Indian Khaddar. They have so successfully imitated the Indian products that the unscrupulous dealers very easily pass off the Japanese product for Indian.

During the Great War of 1914-18, when supplies of cotton goods from Lancashire became scarce, a great stimulus was given to Japanese cotton manufacture, but since the War, Japan has lost much of the advantage then gained.

A very large quantity of cotton is produced in China but it is generally inferior to Indian cotton. The Chinese cotton suffers greatly from excessive heat and the soil is not very suited to its growth. There is no apprehension of China ever turning out a serious competitor of India, for the home demand in China is too large to allow exportation.

Apart from tree cotton the outlook for cotton in India is only moderately promising. The long stapled foreign cottons do not grow as well as in America although they are cultivated over large areas in the Punjab and the Egyptian is grown in Sind. Only a small percentage of Indian cotton is now imported by England. Much of this cotton is, however, used in India and Japan. India is even now a

large buyer of foreign cotton. Now that Mesopotamia has been brought under British control, a very large quantity of cotton of good quality may in course of time be grown there, but only if the irrigation works are improved and extended. The case of India is not, of course, altogether hopeless. She may, with proper care in future, reproduce the quality of cotton of which the Dacca stuffs (Muslin) were once made. But it would not pay for cultivation under the present conditions.

Brazilian cotton resembles the West Indian and the American in the length of the staple but the excessive heat makes it a little coarser. Actually a considerable quantity of good cotton is sent to England from Brazil mainly through the ports of Pernambuco and Bahia. A large quantity of almost similar cotton is also sent to England from the Sudan, Uganda and Nyasaland.

Now the spread of civilisation and the rise in the standard of comfort are increasing the demand for cotton, and so there is need for increasing the areas of cotton production. Fortunately there is immense possibility of increasing such areas. The Eastern and Central Sudan can grow unlimited supplies of cotton of the Egyptian type. The West Indies can grow more long stapled cotton of sea-island quality than they do now. In the United States of America any increase of the available lands is more difficult, and any increase of the cotton area there should be of sea-island quality in view of the fact that the Egyptian cotton supply has reached its maximum and is on the decrease. Besides United States of America, Northern Nigeria, Nyasaland and the British East African colonies of Tanganyika and Kenya can produce huge quantities of the cotton of the American

'upland' type. Asiatic Russia, with fairly cheap labour and land, is becoming more and more important as a cotton exporter and is relieving the pressure on ordinary American upland. Her chief difficulties are transport and deficient rainfall. The problem of water supply is partly being overcome by irrigation, but it is expensive. In all probability with improvement of transport and irrigation Asiatic Russia would be an important grower of 'upland' cotton, for there is a vast area of cheap land suitable for the growth of cotton if water could only be applied.

FLAX.

Flax is probably a native of Southern Russia and even now Russia leads the world in production and export of flax.

Next to cotton the vegetable fibre of which much clothing is made is flax. In connection with it and the supply of suitable water there is an important linen industry in Ulster, the east coast of Scotland, Flanders, Germany, Russia and Czecho-Slovakia. All these places import most of their flax from the Baltic States and Russia, though a small amount is grown locally.

In the British Isles the most important centre of linen manufacture is in North Ireland (Ulster). A large amount of flax is grown locally and this, with easy importation of coal from Ayrshire and flax from the Baltic States and Russia, has resulted in the development of a linen industry. The centre of the industry is Belfast. The other linen towns are Londonderry, Newry and Drogheda. The industry in Scotland mainly depends on the importation of raw material from Russia and coal from the Fife Coal field. The chief centres of linen manufacture are Dundee

and Dunfermline. In the Tees basin the chief linen centres are Darlington, Stockton and Sunderland.

In continental Europe the important linen towns are Ghent Courtrai and Bruges in Belgium; Lille and Valenciennes in North-east France.

Flax grows best on soil that has been fertilised for ages with decayed vegetable matter such as leaves of deciduous forests. It also grows well on alluvial soil with a damp climate. The finest fibre is grown on the alluvial soils of Flanders and Holland where the air is damp and the sky is overcast. There the land is low and flat and is exposed to sea-winds. The soil must be rich; because flax exhausts the soil very quickly, and it is for this reason that flax is ordinarily grown every five years.

It grows under a very wide range of climates. It is grown both in temperate and tropical latitudes but the essential product varies with the mean temperature of the place. If the temperature is low the flax plant yields good fibre but poor seeds. Speaking broadly places with high temperature grow flax mainly for the seed from which linseed-oil is obtained and there the fibre is a mere by-product, whilst places with low mean temperature grow flax for fibre the seed being merely a by-product.

In India the flax is grown chiefly for seed, and Calcutta is now one of the greatest linseed oil markets in the world. In Russia the flax is grown for fibre and it has the largest area of any non-food crop. Russia with its cheap labour and land is thus able in normal times to supply four-fifths of the world's demand for the fibre. The plant requires a great deal of cheap labour both on the field and in its earlier manufacturing processes for fibre. It is therefore widely cultivated in Russia, Northern Italy, Northern Ireland

and other countries where labour is cheap. This low wage is primarily due to the low standard of civilisation which allows women to do hard out-of-doors labour. Besides these countries the United States of America and Argentina have large areas under the flax plant. In the United States of America and other countries where labour is dear the plant is grown for oil. The British Isles import both the linseed and the flax in large quantities. While half the seeds come from India and a quarter from Argentina, more than three-fifths of the flax comes from Russia and about one-third from Belgium.

It has been already observed that the flax plant is grown in India and other places of high temperature for linseed, which is valuable because of the oil extracted from it and the oil-cake which is a very important cattle food. Several attempts have been made in India to extract flax from the Indian plant but without much success. Over 5,000 square miles of land are under cultivation for linseed. The crop is very important in the Central Provinces and Berar. It is also extensively grown in Bengal, the United Provinces and Bombay.

WOOL.

Of the animal products of which clothing is made wool is by far the most important. Though some wool is obtained from the lama, the alpaca, and various kinds of goats yet it is mainly obtained from sheep. Sheep thrive best in a dry temperate climate. They cannot do well in a moist climate. They prefer dry sunny air more than anything else, and need very little attention except at the time of lambing and shearing. They do very well on poor pastures, only

the area devoted to each sheep must be large. Consideration of the last point *viz.*, large pasture area drives our attention to comparatively ' new ' countries where there is abundance of the cheap dry land, so essential for sheep.

The supplies of wool, like those of meat, as already noticed, must be from countries which possess vast grass lands. Consideration of this fact at once fixes our eyes on the grass'ands of Australasia, South America and South Africa. The people of the grassy downs of almost all ' old ' countries are, no doubt, raisers of wool, but they all need their product for home manufacture and nothing is left for export. Great Britain, France, Germany and Russia all produce more or less wool but, in addition to their home supplies, they have to import large quantities of wool for their factories.

The chief exporters of wool in order of value exported are Australasia ; Argentina and Uruguay (the Plate basin and Patagonia) in South America, and South Africa. Australasia leads the world in the wool trade. Amongst the Australasian Colonies, New South Wales, New Zealand and Victoria have the largest trade.

Australia is a big saucer-like table land, the edge of which is bordered by mountain ranges. This has a remarkable effect on the rainfall of the continent. The bordering ranges compel the rain bearing winds to give up their moisture on the windward sides of the ranges with the result that the interior of the continent suffers greatly from deficiency of rain. Part of the centre and west of the continent is occupied by deserts. In the interior of New South Wales and Victoria, west of the Great Dividing Range, there are vast areas of grassland and plains covered with a semi-desert type of vegetation called " Salt-bush " which

is an excellent food for sheep. These lands are cheap and so long as it pays to stock the "runs" lightly, scarcity of rain is rather an advantage to the farmer for it makes wool better. New South Wales is now the largest exporter of wool.

The best Australian wool is, however, exported from Victoria and the wool is called "Port Philip." The air in Victoria is drier, the climate cooler and the soil richer than in New South Wales, and they all have combined to produce a wool that is almost unsurpassed for softness, lustre and length of staple. The Victorian wool is amongst the best in the world. Melbourne, the port of Victoria, is nearly as good a harbour as Sydney, and has better railway facilities than Sydney the port of New South Wales, but the latter is more conveniently situated with regard to the supply of coal. A woollen manufacturing industry is becoming established in Australia, especially at Geelong in Victoria.

In South America the wool is obtained from the llama and the alpaca as well as from the sheep. In the Cordillera it is raised from all these animals but the Plate Basin and Patagonia products are entirely from sheep. The Plate basin includes parts of Uruguay and Argentina. Though the latter has much the larger area, the former with her better rainfall has much the denser distribution. The growing of wool is very promising there, for both land and labour are cheap. Not only is the land cheap and water supply plentiful and well distributed, but the transport is also very easy, for the land is so level that one may travel hundreds of miles by rail without seeing an embankment more than three feet high. There are also excellent shipping facilities from Buenos Ayres and other ports. Great Britain has not much trade

connection with this region as far as wool is concerned. The principal customers of the Plate basin are Germany, France and other countries of Central and Western Europe. The chief importing ports are Havre, Dunkirk and Antwerp. The Plate basin and Patagonia have no doubt prospects of becoming more and more prominent as producers of wool.

New Zealand occupies a very important place among the wool growers in the British Empire and her position is second, Australia occupying the first place. The New Zealand farmers have a few advantages over their Argentine rivals. The insular climate is very mild; many of the soils are of volcanic origin, rich in potash and support a growth of very nourishing grass.

The rich, healthy pastures of Auckland, Hawke's Bay and Taranaki can therefore support a larger number of cattle or sheep per acre than in Argentina. In the South Island the rearing of sheep is the most important occupation in the Canterbury plains which are cut off from heavy rains by the Southern Alps. Port Lyttleton exports annually a very large amount of wool, mutton and other animal products. In both islands the sheep thrive in the drier east, the cattle in the wetter west. The other important wool ports of the Dominion are Napier, Wellington and Dunedin.

South Africa raises much less wool than the Plate region, but it is more important to Great Britain than the Argentine. The chief exporter of wool in South Africa is the colony of the Cape of Good Hope. It is also, like Australia, a plateau, with the chief mountain ranges in the east, and is nearly in the same latitude as South Australia and Victoria. But there is one great difference in the formation of the table land. The South African plateau rises in several

terraces from the damp coastal plain whereas the Australian plateau rises steeply from the sea and sinks in the middle. In both countries, however, the rainfall is scanty and confined to the coast, the loose soil allows rapid sinking of water and evaporation is quick. But on the third terrace of South Africa there is a layer of clay which retains moisture longer and contains salt which is useful in the sheep-food. A most valuable kind of shrub thrives in this region, which is called the Great Karroo after the Hottentot name of this shrub (the Karroo bush). It is an excellent food for Merino sheep and Angora goats. A large amount of wool and mohair (from the goats) is exported, mainly from Port Elizabeth, East London and Cape Town, to England.

At present the British Empire practically controls the world's wool markets, though Argentina is rapidly coming to play an important part. London is even now the centre of wool trade, though Germany, France and other nations of Europe have opened direct trade. The wool that is not re-exported is sent from London to Bradford for distribution on the Yorkshire Coal fields for manufacture.

In the Yorkshire Coal fields the centre of the industry is Leeds. Bradford makes worsteds and Halifax blankets and carpets. The other towns engaged in this industry are Huddersfield, Wakefield, Dewsbury and Barnsley. There are many other small woollen towns in England and Scotland.

On the continent of Europe woollen goods are chiefly made on the Saxon and Silesian Coal fields of Germany, the Belgian fields, the Northern Coal fields of France, the Bohemian Coal fields in Czecho-Slovakia and also around Lodz in Poland. The sheep on the hills of Central Europe supply a part of the raw

material required, but much is now imported from Australasia and the southern part of South America and is carried up the long navigable rivers to the coal fields.

Verviers and Brussels are the chief centres of the woollen industry in Belgium. Important centres in France include Roubaix; in Germany Aix-la-Chapelle, Chemnitz and Breslau, in Bohemia Reichenberg; in Spain Barcelona and in Italy Turin.

In North America woollen manufacture is carried on in the Eastern Pennsylvanian coal field and in the New England States. The chief centres of this industry are Philadelphia and Boston.

Indian wools are of inferior quality and are generally classed in the grade of carpet wools. The breeding of sheep in India either for mutton or for wool has not be seriously studied. The export of wool from India also includes wools imported by India from Persia, Afghanistan, Central Asia, Tibet and Nepal. Quetta, Shikarpur, Amritsar and Multan are the chief collecting centres for wool. In connection with the wools imported from Tibet and the local supply there are manufactures of shawls at Amritsar and at Multan in the Punjab. In the latter town shawl weaving was a very thriving industry in the past, but now its place has been taken to some degree by the manufacture of shawls from imported worsted yarns, but more generally by the manufacture of carpets of fine quality. Manufacture of carpets and blankets is also an important industry in the United Provinces. Woollen goods are also made on a small scale in other places but they are not important. There is also a large manufacture of wool in Mysore, but the Indian goods are mainly for use in India. A very small percentage of the total production is exported.

SILK.

Besides wool the most important animal product of which clothing is made is silk. It is obtained from the silk-worm which generally feeds on mulberry leaves. The silk-worm is a native of South-east Asia. Both the silk-worm and the mulberry are indigenous to China and it is probably from China that the art of silk culture and manufacture gradually spread westward. The silk industry, like the tea, requires much careful labour and therefore monsoon and warm temperate lands with their dense population and mulberry groves on hill sides have special advantages so far as this industry is concerned. In China, between 30° and 35° N, the industry is practically universal, but about one-fifth of the silk is wild. The best mulberry groves are in the provinces of Chekiang and Kwang-si. The silk of this region is mainly exported from Shanghai and Canton. In the export trade China occupies the second place, Japan occupying the first.

The chief rivals of Canton and Shanghai in the silk trade are Osaka and Kobe. The slope of both China and Japan is towards the east *i.e.*, towards America, and it is natural that both of them would try to seek markets for this precious commodity in the United States of America. But the position of Japan with respect to America is certainly better, for she is nearer and has better shipping facilities. Even in the production of silk Japan has some natural advantages over China. The insular climate of Japan encourages a freer growth of leaves than in China.

The silk industry is a most important one in Japan and silk is the largest item in the list of exports. In the interior of northern Hondo it is the main industry and Kioto, the old capital, is the centre of the mul-

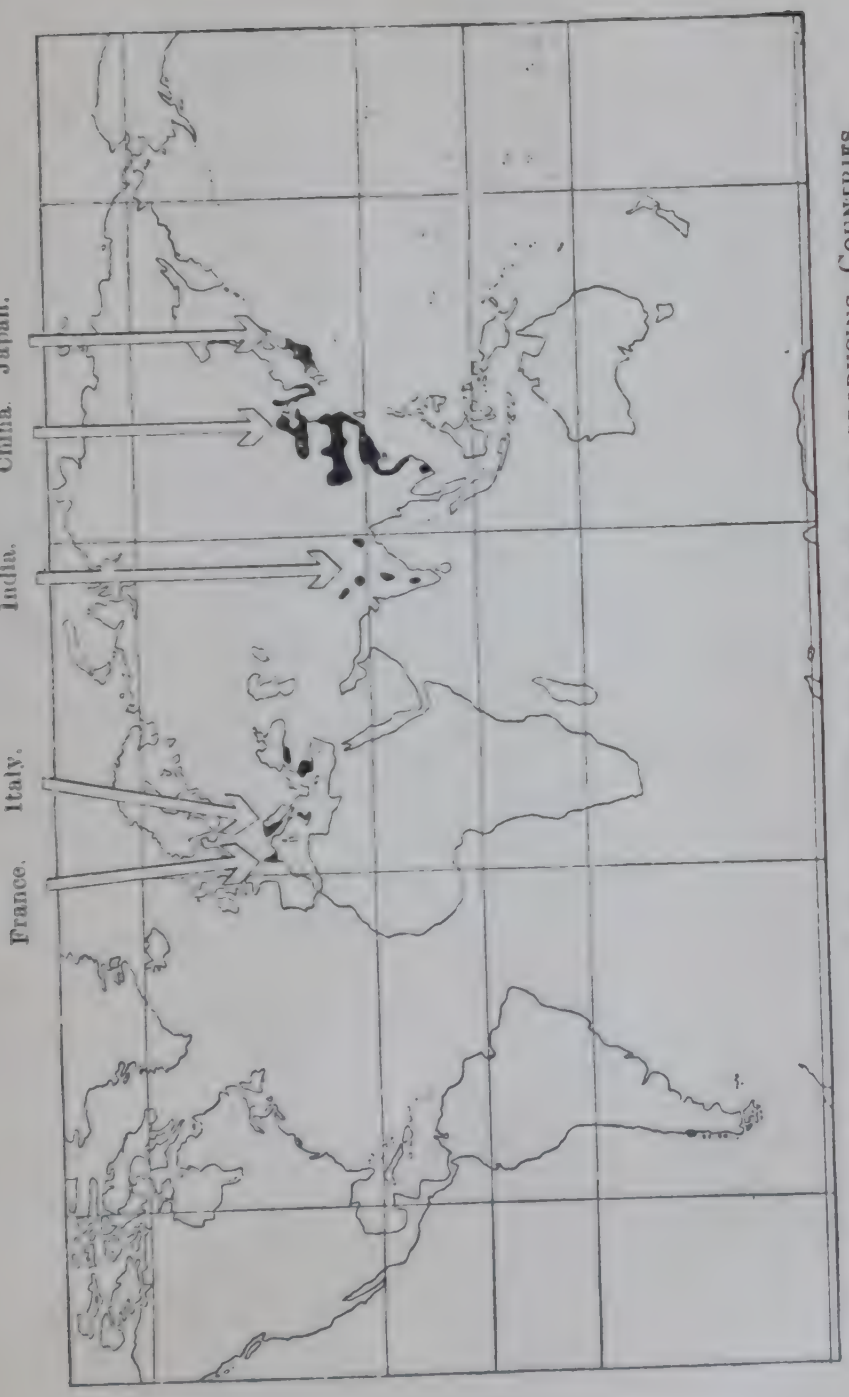

FIG. 40. MAP OF THE WORLD, SHOWING THE CHIEF SILK PRODUCING COUNTRIES.

berry groves. It is connected by rail with the neighbouring ports of Osaka and Kobe and with Yokohama. Besides America; France, Italy, India, Indo-China and England are large customers for Japanese silk.

The semi-tropical parts of the monsoon lands have, like the temperate areas, sericulture as one of their industries, but it is of relatively smaller importance. In the early days of the East India Company silk weaving was one of the principal textile industries of India. She had, indeed, a great name in the past, both in the West and the East for her precious silk and muslin, but unfortunately she has lost her former glory. Her place in the silk industry is now occupied by France, the producer and manufacturer of the finest silk in the world. The decline of the silk industry in India was due partly to the rapid development of sericulture in France and Italy, where it became a part of the agriculture, and partly to the negligence of the Indians who did not make any serious attempt to retain their industry. The Indians are still more or less content with the defective systems of rearing and of hand-weaving.

The silk industry on a large scale is mainly confined to the temperate parts of India, though it is quite an important industry in Mysore and the Nilgiri hills. The chief silk centres of Northern India are in Bengal, Assam, Kashmir and some places along the Himalayas and in Baluchistan. Here the mulberry trees of the European silk producing countries are often grown specially as food for the silk-worm. But the most common mulberry of Bengal, Assam and the Nilgiri hills is a local species known as *M. indica*.

India has three varieties of purely indigenous silk-worms, *viz.*, the tasar, muga and the eri. Of the three the first is the most important and is widely dis-

tributed. Murshidabad is the centre of the tasar (or tussore) silk in Bengal and there is a Government sericulture farm at Berhampore. Murshidabad stands on the Ganges and the Raniganj Coal field is close to it. The tasar silk is obtained from the adjacent hills of Chota Nagpur and from those of Kashmir. Murshidabad is joined to Calcutta, the port and capital of Bengal, both by rail and by water. The local supply of raw silk and coal together with easy market facilities is responsible for the development of the silk industry in this town. The other centres of silk in Bengal are Rajshahi and Midnapore.

The muga silk is confined to Assam and Eastern Bengal and the silk worm of this variety feeds on a laurel. The eri silk is extremely difficult to reel and is very often carded and spun. It is practically confined to the Khasi hills of Assam.

During the last European War the Indian silk industry made some progress and this is evident from the increased value of the silk exported. The value of the export during 1915-16 amounted to Rs. 27½ lakhs, of which raw silk accounted for Rs. 24 lakhs. This increased value of export is not, however, a very good way of accounting for increase in production. The lack of progress is evident from the quantity of goods exported. In 1920-21 the exports of silk yarn amounted to 783,448 lbs. compared with 1,167,530 lbs. in 1913-14: Silk piece goods exported were 22,432,974 yards as against 27,338,272 yards. Compared with other exports of India—jute, cotton, tea, etc., silk and silk goods occupy a very minor place.

It has already been noticed that France and Italy are the largest producers and manufacturers of silk in Southern Europe and that the mulberry trees are amongst the most important trees of the silk regions. In fact,

Italy is only behind Japan and China as a producer of silk and occupies the third place both in the production and export of silk. The important centres of sericulture in Italy are in Lombardy, around Venice and in Piedmont. Turkey and France are just behind Italy as producers. France, on the other hand, is superior to Italy as a manufacturer and the French silk is considered to be the best in the world.

The silk industry of France is localised on her southern coalfields. The most important centres are Lyons and St. Etienne; the former specializes in silks and velvets and the latter in ribbons. The chief rivals of France in this important branch of her industry are Italy, Germany, Switzerland and England. A part of the raw material is available locally but the rest is imported mainly from China and Japan through the port of Marseilles.

The centre of the silk industry in Italy is Milan. Its admirable position in the centre of the plain of Lombardy commanding all the important routes from the different parts of the country and the routes leading out of it to the Central and Western European countries together with its advantage of falling water for the production of electricity, is mainly responsible for its prosperity. The progress of manufacture was formerly hindered by the absence of coal but now the water-power of the Alps and the Apennines is being increasingly employed.

The silk industry in Switzerland has increased rapidly in recent years. This progress is chiefly due to the opening of St. Gothard Tunnel which allows direct importation of raw silk from Italy, presence of water-power, abundance of cheap skilled labour and the advantage of market facilities which are mainly due to the situation of Switzerland in the centre of the

densely populated parts of Europe. The important centres of this industry are Basle, Zurich and St. Gall.

The important silk centres in England are in Derbyshire, Staffordshire and Cheshire.

In recent years there has been an increase of the silk industry in the United States of America. This industry, unlike the wool, is confined to a particular region. The centre of the industry is New Jersey, though it spreads westward into Pennsylvania and eastward into Connecticut. The raw silk is mainly imported from the west, from China and Japan, but the cost of transport in so little compared with the total value of the finished commodity that it is not a matter of much importance. The great metropolis of New York affords the best markets: the Italian immigrants who were originally imported for the heavy mining work of Eastern Pennsylvania supply much of the skilled labour. In Pennsylvania the silk mills are in or near the great coalmining towns, *e.g.*, Scranton and Wilkesbarre. Pennsylvania occupies the first place in this industry as a State, but the best silk town of the United States of America is Paterson which is not far from New York.

THE COCONUT AND ITS PRODUCTS.

The familiar coconut palm is a valuable tree. The outer covering of the nuts yields a strong fibre called coir; the kernel of the nut when dried is called copra. The coconut flourishes in tropical lands in a sandy soil near the sea, and the drying and export of copra is an important industry in Ceylon, Malaya, and along the West Coast of India.

The copra is manufactured into soap and into margarine which is very like ghee or butter. Coconut oil is also obtained from the kernel of the nut.

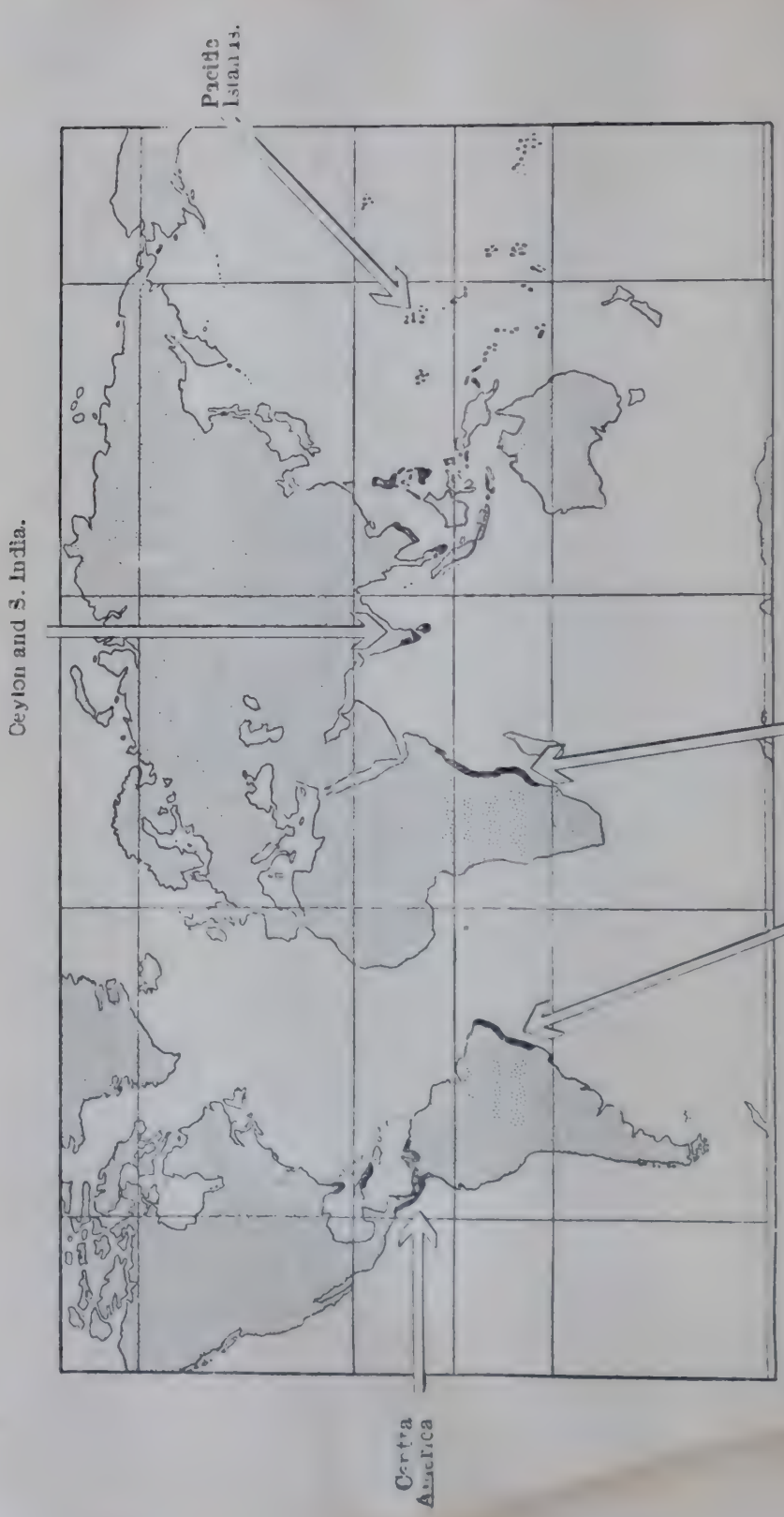

FIG. 41. MAP OF THE WORLD, SHOWING TROPICAL SHORELANDS AND ISLANDS WHERE COCONUTS ARE GROWN

In West Africa the oil palm takes the place of the coconut.

RUBBER.

Rubber is made from a white milky juice obtained from the bark of several trees and climbers, all of which are natives of the Equatorial Forests. In the

Photo. L. D. Stamp.

FIG. 42. COCONUT PALMS ALONG A SANDY SHORE, CEYLON.

early days of its discovery the rubber was obtained from trees growing wild in the forests. The trees were cut down in order to obtain as much rubber as possible. As a result the rubber trees became harder and harder to find. A little wild rubber is still obtained from Brazil and the Congo basin but now

nearly all the rubber of commerce is obtained from plantations. The tree from which it is obtained is a native of Brazil. British Malaya (Straits Settlements and Federated Malay States) produces more than half the world's supply; huge quantities are obtained from Ceylon and the Dutch East Indies,

(From Whitby's 'Plantation Rubber.')

FIG. 43. TAPPING A RUBBER TREE.

and a little from Brazil and Southern India. Huge quantities are used by the United States and England in the manufacture of motor tyres.

JUTE.

Jute is a strong fibre used for making sacks (gunny bags) and ropes. It is obtained from the

stem of a plant which grows in hot wet countries in swampy land. Nearly the whole of the world's supply comes from the Ganges Delta and jute forms one of the chief exports of India.

HEMP.

Hemp is a strong fibre used for making string and rope. It is obtained from several different plants. A variety with soft fibre is grown mainly in temperate lands—especially Russia; varieties with harder fibre grow in tropical lands especially in the Philippine Islands, Central America and East Africa.

CHAPTER IV.

Manufactures.

It has been seen how man's activity is to a great extent limited by nature. Definite amounts of light, moisture and warmth are essential for animal and vegetable life. Very cold or very dry areas may be without vegetation. The greater the temperature the larger is the amount of moisture needed for vegetation, and the moisture which is sufficient for higher latitudes is quite inadequate for lower ones, for the fierce rays of the sun cause very rapid evaporation. The most important thing with regard to rain is its seasonal distribution. Here men have to a great extent improved upon nature by preserving rain water in tanks and other reservoirs, and by regulating the waters of the rivers by constructing dams and distributing the water thus preserved throughout the year. It has also been noticed how stock-raising and sheep farming are the chief occupations of the people whose lands get rain and sunshine sufficient only for the growth of grass, but inadequate for cultivation, and how in the forest areas lumbering and hunting are the principal occupations, and cultivation is carried on only in the clearings of the forest. We have thus a rough idea as to how people live in different parts of the world. Their activities may fittingly be classified into five broad divisions (i) Agricultural and Pastoral pursuits; (ii) Mining; (iii) Manufacture; (iv) Commerce and (v) Professional. Agricultural and some industries have been briefly noticed in connection with regional divisions and

commodities. Now we shall confine our attention to manufacture. We have already referred, in the last chapter, to some of the great textile manufacturing regions of the world.

Manufactures, to be successful in these days of keen competition, must be on a large scale. Large capital and very great organising capacities are called for. The three most essential elements for manufactures are (1) power, (2) raw material and (3) labour. Climatic elements are now less important, since manufactures are now-a-days carried on in large factories. It is true, however, that work can be done with a high degree of efficiency only in regions where the summer is neither too hot for factory work, nor the winter too cold for out-door work. This is probably one of the reasons why the chief industrial centres of the world are confined to the temperate zones.

In early days the source of the supply of raw materials to a great extent determined the location of the industry, because transport was then a very difficult and costly affair, and hand-power was largely employed. At a later period power was obtained from running or falling water and moving wind. Hence early factories were started by the side of streams and in places where winds could be utilised. At the same time it was seen that they must not be very far away from the sources of the supply of raw material, for distance involves expenditure and trouble. The woollen industry in Yorkshire began in this way. The sheep of the Pennine pastures and Yorkshire Wolds supplied the wool and the streams running down from the steep hill sides the required power and the water necessary for bleaching and dyeing. Transport is now so easy, cheap and regular

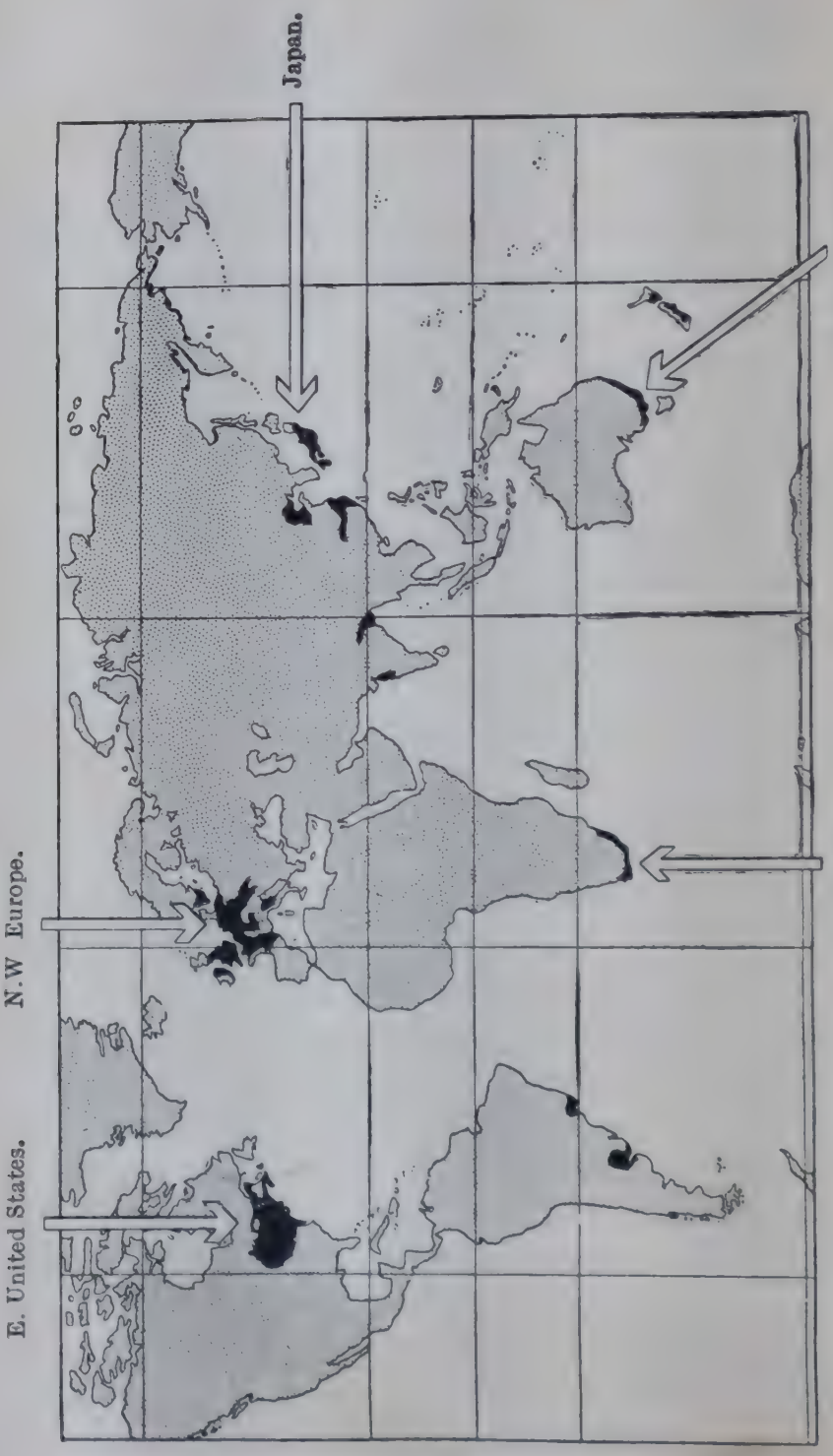

FIG. 44. MAP OF THE WORLD, SHOWING THE MOST IMPORTANT INDUSTRIAL REGIONS.

that the supply of raw materials is not the main thing in the selection of sites for factories. Now the primary condition is the possession of cheap power. The necessary power is derived either from coal or oil or running water. Coal is heavy and large quantities of it are required. Hence the cost of transporting coal from the coalfield to other regions is very great, and during last century there was a tendency to bring the raw materials to the coalfields and manufacture them there, rather than to transport the heavy coal to the place where the raw material was produced. Hence manufacturing centres grew up on the coalfields. Moreover iron and steel are required in large quantities in manufacturing and the occurrence of iron ore and coal in close proximity was a matter of greatest importance. England was fortunate in possessing deposits of iron ores near several of her coalfields, and, although these supplies have been practically exhausted, the iron and steel industry is still associated with certain of the coalfields. The same is true of America. Of recent years, oil has assumed a great importance as a fuel. The great oilfields of the world have not become manufacturing areas, for the oil is easily pumped for large distances through pipes. In the present century coal, oil and running water have all been used to generate electricity. The electric current can be taken for even hundreds of miles across country, and so the manufacturing industries which depend for their power on electricity need not be situated where the electricity is actually produced. Of recent years there has thus been a tendency to decentralise industries; industrial regions are no longer restricted to coalfields. But many coalfields became centres of manufacturing industries in early days and their importance has not

decreased. Practically now-a-days all work is done by machinery, for the production of which a very large amount of iron is needed. The chief fuel used in setting the machine in motion is—either directly or through electric power—coal. It follows, then, that countries which possess these two, coal and iron, in large quantity and in close proximity with each other and have the required climatic elements, must make rapid progress in manufactures, provided that the people are energetic and inventive. In most cases the factories will still gravitate to coal fields and the best situation for factories may still be the place where coal and iron are found together.

Coal is principally of two kinds, anthracitic and bituminous. Of the two, the latter is the more important. The difference between the two is due to difference of proportion of carbon to gas and tar. The bituminous coal contains about 85 per cent of carbon, and the anthracite about 95 per cent. The former burns quickly and is the chief fuel used for domestic purposes and gas making; the latter burns slowly but produces very great heat. This is the reason why anthracite is used mainly in smelting work.

Before the Great War of 1914-18, the four great coal-exporting countries were Great Britain, Germany, United States and Belgium, and of these four Great Britain was the most important. The entry of the United States into the export field was comparatively late and has caused great competition with this important branch of British trade. The States have several advantages over Britain in the production of coal. The seams of coal are very much thicker and the fields, though less numerous, are larger. Again the American seams are more or less uniformly

horizontal and above the water level whereas the British seams are sometimes very much inclined and far below the sea level. The hoisting of coal in Britain, therefore, requires more expensive and complex machinery and more men. It is no wonder therefore that the price of coal in the States is much less. This advantage of larger supply and lower price with regard to coal has made the United States of America the greatest rival of England, not only in the export of coal but also in manufacture, especially of railway plant. The Virginian coal is, indeed, gradually driving away the Welsh and the English coal out of the markets in the east coast of South America, and it is quite probable that the Virginian coal will be the great rival of the coals of Cardiff and the Tyne ports in the North Atlantic as well, in a short time.

The other rivals of Britain in the coal trade include New South Wales, Japan, (with anthracite) and Natal. India also is increasing in importance. The New South Wales coal is now shipped regularly to Ceylon, Burma, China and the Straits Settlements. The other Australian States also take large quantities of coal from Sydney. Bengal coal has also nearly supplanted British coal in the east coast of India.

In the possession of coal, iron and limestone together in one place, so important in the early days of the Industrial Revolution, Great Britain had no very serious competitor. The other two great producers of coal, the United States and Germany have also conveniently situated iron-ore deposits. In fact, these three countries have the largest transport and manufacturing industries in the world. Ship building has made wonderful progress in the United Kingdom; the production of railway materials in the

States and general manufactures in Germany. Belgium by virtue of her possession of coal and iron, is also their rival, especially in the textile and iron industries, though the last European War has done greatest harm to her.

Another very important thing to be remembered in this connection is that the iron and coal deposits, to be of immediate economic value, must be easily accessible by water; otherwise the transport charge would be too heavy. Where natural waterways do not exist canals have to be constructed. A study of the coalfields of the great manufacturing countries of the world and the chief industries that sprang up on them will make this evident.

One of the most famous coalfields of England lies in Northumberland and Durham on the banks of the river Tyne. On the north bank of this river stands Newcastle which has given its name to many other coal-exporting ports. The other important towns are North Shields and Tynemouth. On the opposite bank the most important centres are Gateshead, South Shields and Jarrow. The Tyne ports even now export more coal than any other centre except Cardiff.

Huge quantities of coal are now consumed in the iron-works and shipyards of Newcastle, Sunderland, Middlesborough and other industrial centres. The iron ore is obtained largely from the Cleveland iron field in Yorkshire.

In the order of their production these are the chief coal producing countries of the world :—

United States, Great Britain, Germany, France, Poland, Czecho-Slovakia, Belgium, Japan, India, Canada, Australia and Holland.

Of these the United States, Great Britain and Germany produce more than three quarters of the

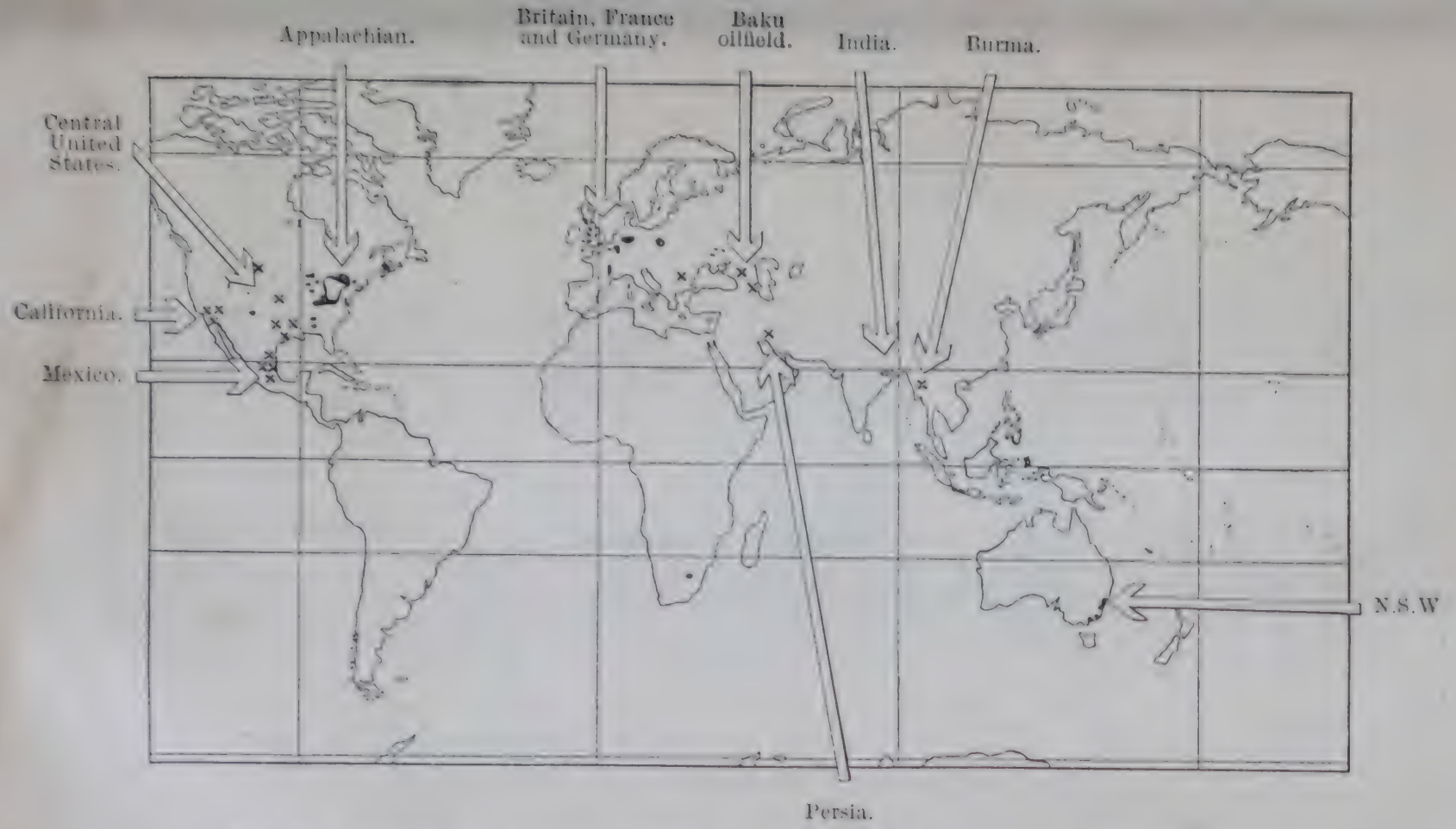

FIG. 45. MAP OF THE WORLD, SHOWING THE DISTRIBUTION OF COAL AND PETROLEUM.
The Coalfields are marked in solid black and the Oilfields by crosses.
There are now important Oilfields in South America.

world's total. In the British Empire, Canada, Australia (with New Zealand), and South Africa have roughly equal productions, India has slightly more.

The Chief Coalfields of the World considered as industrial regions.

THE ENGLISH FIELDS.

The Pennine fields.—Large deposits of coal exist on either side of the Pennine range, and this range being nearer to the west than to the east, the Lancashire fields and industrial areas are nearer the seaboard than those of Yorkshire. In the former, cotton weaving and spinning is the most important industry and in the latter the woollen industry predominates. The damp climate of Lancashire is particularly suitable to cotton manufacture. Liverpool, the port of Lancashire, has an admirable position with regard to its large trade with America in grains and cotton. The United States is the largest producer and exporter of raw cotton in the world. On the other hand the drier climate of Yorkshire is quite suitable for the manufacture of woollen goods. The industry had its origin in the possession of raw material in the locality and supply of pure water so essential for bleaching and dyeing. A small quantity of fine lustrous wool is even now obtained from the Pennine pastures and Yorkshire Wolds. Besides Yorkshire has easy access to the sea through the ports of Hull, Goole and Grimsby. The chief centre of the Yorkshire woollen industry is Leeds. Bradford specializes in worsted, and Halifax in blankets and carpets. The other towns engaged in this industry are Huddersfield, Wakefield, and Dewsbury. Outside of Yorkshire the only important woollen manufacturing areas in the

British Isles, are in the South of Scotland and West of England. The sheep bred on the Southern Uplands of Scotland are responsible for Tweed and Cheviot cloths manufactured at Galashiels, Hawick, Selkirk and Dumfries. On the central coal fields of Scotland

FIG. 46. THE COALFIELDS OF ENGLAND.

the woollen industry is important at Stirling and Alloa. On a small scale it is carried on in the West of England at Stroud in Gloucester and at Trowbridge in Wiltshire. Sheffield has a world-famous cutlery industry. Just as the cotton industries are

concentrated on the Lancashire Coalfield and the woollen industries on the Yorkshire field; so the iron and steel works of England are centred on the Northumberland and Durham fields. The iron ore

FIG. 47. THE INDUSTRIAL REGIONS OF ENGLAND.

is easily brought by water from Middlesborough (the port of the Cleveland Ironfield of Yorkshire). Also the Tyne ports face Scandinavia, from whence supplies of first quality iron ore are brought.

The South Wales Coalfields, like the Tyne, have great facilities for transport for they are very close to the sea. This easy access has contributed greatly to the rise of the ports of Cardiff, Newport, and Swansea. In fact, in normal times Cardiff exports more coal and more tin-plate than any other port in the world, and as a coal port it has surpassed even Newcastle. The anthracite of the western part of this area has made South Wales specially noted for smelting work. Formerly large quantities of tin were shipped from Cornwall, but now huge quantities of it are also imported from Straits Settlements and Nigeria. Swansea is noted for copper-smelting, and Merthyr-Tydvil has important steel works. Large quantities of copper and iron are imported from Spain, the former from Huelva and the latter from Bilbao. Iron is also taken from Northern Sweden through the port of Narvik in Norway.

Midland fields.—There are some important coal fields in the Midland counties of England. They have no natural waterways for transport. Their position, however, between the Severn and the Trent has made it possible to establish connection between them and the sea by constructing railways. Important industries have, therefore, developed on these fields. This coal area extends over parts of North Staffordshire, Leicestershire, Warwickshire and South Staffordshire. On the Staffordshire coal fields the towns of the Potteries, *viz.*, Stoke-on-Trent, Hanley and Burslem, make china and earthenware. The industry began with the fine clay of the locality, which is now exhausted. China clay is now brought from the old decayed granite of Devonshire and Cornwall by sea and by canal. The Warwickshire Coalfield has long been associated with iron manufactures. In this

region is the well-known "Black Country." Birmingham, the abode of smiths and cutlers, is the centre of the industry. Wolverhampton, Wednesbury, Walsall, West Bromwich and Dudley are other important iron-towns. Coventry makes motor cars, cycles and watches. On the Leicester field Northampton makes boots and shoes, and in Leicester hosiery, boots, tobacco, and lace are manufactured.

THE SCOTTISH FIELDS.

The Central Lowlands of Scotland possess very rich coalfields, and iron also is found in the neighbourhood. Communication, too, is very easy here, for the Clyde is joined to the Forth by a canal. This portion of Scotland has in consequence become one of the busiest and most densely populated regions in Britain.

Rich deposits of coal are found in the Clyde basin; in Ayrshire, and along the banks of the Firth of Forth, and these areas have exceptional facilities for transport by sea, canal and rail. There are iron deposits, too, close to them. The chief iron fields exist between Edinburgh and Glasgow, and in Ayrshire. It is no wonder, therefore, that the Central Lowlands in Scotland support a very large population like other industrial regions in Britain.

In the Clyde Basin Lanark is the chief coalfield. The iron industries on this field centre at Glasgow, the second city in the British Empire. It is surrounded by a ring of iron-towns. Coatbridge, Airdrie, Motherwell, Hamilton and Wishaw smelt and manufacture iron. Paisley makes cotton thread and Renfrew silk and muslin. Again in connection with iron and coal, ship-building has become a very important

industry in the Clyde estuary, viz., at Greenock, Dumbarton and Port Glasgow. The Clyde basin is the most important ship building centre in the world.

The Fife Coalfields extend from Stirling to Methil which is one of the coal exporting ports in Eastern Scotland. The other ports, Grangemouth, Burntisland and Kirkcaldy send coal to places like Dundee, Arbroath and Aberdeen. The coal of this region also feeds the iron-works of Falkirk and the linen factories of Dunfermline. Dundee, the largest town on the east coast, manufactures linen and jute, and is a ship-building centre. On the Midlothian Coalfield there are no large industrial centres except Edinburgh with its port, Leith. The former is famous for brewing, distilling and printing. Paper is also made in the neighbourhood.

The Ayrshire coal supplies fuel to the iron works and woollen factories at Kilmarnock. Much is sent out through Ayr and other ports to Belfast in Ireland, which is famous for ship-building and linen manufactures.

U. S. A. COALFIELDS.

The United States of America possesses two big areas of real coal—(1) the Alleghany fields and (2) the Central fields. Of the two the former is by far the more important. Very big and rich deposits of coal exist on either side of the Alleghany range. The coals of this area are of three kinds, viz., (i) anthracitic, (ii) bituminous and (iii) semi-bituminous. On the west side of the range lies the bituminous seams and on the east side anthracite. Between the two lies the semi-bituminous.

The anthracite area, though comparatively small, is responsible for the rapid development of Philadelphia. It is almost confined to Pennsylvania. There are also considerable reserves of iron ore here. Very large quantities of iron ore are also brought by lakes and canals to this region from Duluth and Port Marquette on Lake Superior via the lake ports of Toledo, Cleveland, Buffalo and others. In connection with local and Michigan iron and Pennsylvanian coal, the twin cities of Pittsburgh and

FIG. 48. THE COALFIELDS OF THE U. S. A. AND CANADA.

1. Nova Scotia. 2. Pennsylvania. 3. Southern Appalachian. 4. Illinois. 5. Kansas-Oklahoma.

Alleghany have become the greatest iron-centres in the United States. For nearly the same reason Cleveland in Ohio has great iron industries.

The semi-bituminous area is no less important. The coal of this region is of especial value for generating steam. It is for this reason often called ' steam ' coal. The centre of this field is at Cumberland on the Potomac.

The bituminous or ' gas ' coal lies along the west of the whole Alleghany mountains extending from

FIG. 49. THE LAKES REGION OF THE UNITED STATES OF AMERICA AND CANADA.

Pittsburgh in the north to Birmingham in the south. As the richest portion of this area lies close to the Ohio, transport is easy and cheap. The greatness of Birmingham may fittingly be attributed to its situation in the district rich in coal, petroleum, and natural gas. Apart from coal there are immense reservoirs of oil and natural gas throughout the area of bituminous coal. The oil is found in abundance along the lake round Toledo, Cleveland and Oil-city. From there it is taken in pipes to Philadelphia. It is chiefly exported from New York, Philadelphia, Boston and Baltimore. A quarter of this exported oil goes to Bremen and Hamburg to supplement the oil found in Hanover and other areas of lignite in Germany.

The principal of the central coal fields of the States extend form West Indiana to East Illinois, the richest deposit being in Illinois. Coal is often found in this region which cuts readily into cubic blocks and is in consequence called ' block ' coal. The centre of this area is near Terre Haute where the railway from Indianapolis to St. Louis crosses the Wabash river. The coal and iron-ore of this region, to a very large extent, feed the iron works at Chicago, Cincinnati. Indianapolis, Detroit and other towns which specialize in railway plant.

The total production of coal in the United States is now nearly twice that of Great Britain, and vast untouched reserves still exist.

GERMAN FIELDS.

Besides true coal Germany has several areas of lignite. This coal not only supplies raw material for the paraffin and petroleum industries, but also provides fuel for the sugar refineries at Magdeburg,

Brunswick, Halle and other sugar works. This lignitic coal is not as valuable as the true coal which is found in the basins of the Rhine, the Elbe and the Oder.

The coalfields of the Rhine basin occur in Westphalia, along the River Ruhr, and in Rhenish Prussia. In both cases iron ores, too, occur near the coal fields. This combination of coal and iron has rendered Westphalia and Rhine land the most important

FIG. 50. THE COALFIELDS OF GERMANY.

industrial centres in Germany. In Westphalia we find such important iron-towns as the Krupp town of Essen, Dortmund, Bochum and Hagen, but in the Rhineland with its special advantage of having a damp climate textile industries have sprung up. Krefeld and Cologne manufacture silk and Elberfeld, Barmen and Gladbach cotton. Very big industrial centres like Coblence, Bonn, Cologne and Dusseldorf are also

found along the Rhine. They are all accessible by moderate sized steamers from the ocean and much of the trade of Western Germany is carried in this way.

The other two coal areas in the Rhine basin are not so important commercially, though their political importance can scarcely be overestimated. Their supplies of coal and iron are mainly responsible for the prosperity of such towns as Metz and Strassburg which occupy strategic points. The only large commercial centre in the Saar Valley is Saarbruck. Near the Ill lie the famous towns of Colmar and Mulhausen (Mulhouse), the "town of Mills." These industrial regions lie in the former German provinces of Alsace and Lorraine, which have been given over to France in consequence of the last European War.

The Elbe Coal fields lie in the Province of Prussia and the Kingdom of Saxony, and are now very important industrially. In the former Magdeburg is the most important city; in the latter rich coal exists round Zwickau, and here Chemnitz, the Saxon Manchester makes cotton goods and machinery. Leipzig is famous for woollens and printing, and Meissen for Dresden China.

The Oder field occurs in Silesia. It is the largest coal field in Europe and extends into the modern states of Poland and Czecho-Slovakia. A few years ago they were included in Germany and Austria Hungary. The largest town in Silesia though some distance from the coalfield, is Breslau. In connection with iron it has large iron-works. The whole of Silesia, like Saxony, is dotted with small industrial towns. Woollen manufactures are famous at towns drawing their coal from this field such as Liegnitz in Silesia and Lodz in Poland. Lodz is one of the greatest

cotton-towns in the world, whereas Breslau is the largest wool-market on the continent.

BELGIAN FIELDS.

No other European country but Belgium is so fortunate as Britain and Germany with regard to the possession of coal and iron close together. So it is no wonder that Belgium is next to them in the importance of her manufactures. In fact, for her size, she has more manufacturing industries than any other country in the world. Though the total output of her coal and iron is a little less than that of France yet she has the great advantage over France, that her coal and iron-ore are close to each other whereas those of France are far away from each other.

The Belgian Coal fields extend as a narrow strip from east to west through Mons, Charleroi, Namur and Liege. Iron ore is mined in the south of Belgium and in the neighbouring province of Luxemburg. The climate is rather damp and the waters of the streams from the Ardennes have bleaching properties. Hence in addition to iron industries textile industries thrive on the coalfields, the textiles manufactured include linens, cottons and woollens. Linens still form one of the most important of them. This industry began in the middle ages in East Flanders in connection with the flax grown there and the admirable supply of water for bleaching. It is the oldest of the Belgian industries. Its chief seats were Ghent, Courtrai, Tournai and St. Nicolas. Woollen goods are chiefly made at Verviers and cottons at Ghent. Liege, the Birmingham of Belgium, is the chief centre of the iron industry. Other towns engaged in it are Mons, Charleroi and Seraing.

FRENCH FIELDS.

The other countries in Europe are not so fortunate in possessing coal, iron and limestone in one place. Many, it is true, have large deposits of both coal and iron-ore, but they are so far removed from each other that the expense of working is much greater. For instance the best Russian coal exists between Tula and Moscow in the centre of the country, and round Rostov and Taganrog in the South, while the best iron deposits are found in the Ural Mountain east of Perm. Again the coal of Czecho-Slovakia round Pilsen is far from the best iron of Austria at Graz. Similarly while the best iron-ore of France is near Nancy in the north-east, her best coal is in the north round Lille and Valenciennes and round Creuzot and St. Etienne in the south. Since both the raw materials, coal and iron-ore, are so heavy, the transport problem becomes a serious consideration.

France has, however, recently by her victory over Germany in the last European War got back Alsace and Lorraine which she lost by her defeat in the Franco-Prussian War of 1870. These two provinces contain very large deposits of iron and also coal in the Sarre Valley. The transfer of these two provinces has altered the position of Germany as an iron-ore producer. France is now practically the most important raiser of iron-ore in Europe. The iron is now extensively mined in Lorraine. At Nancy, on a tributary of the Mosel, an iron and steel industry has developed. Although the control of the Sarre Coal field is only temporary and the field may be handed back to Germany, its possession has placed France in a very advantageous position against Belgium, her chief rival in the field of manufactures. It is

expected that the remarkable skill, dogged perseverance, and inventive minds of the Germans will soon make up the loss which appears to be irreparable and restore their former position among the industrial nations of the world.

FIG. 51. THE COALFIELDS OF FRANCE.

1. The Northern Coalfield. 2. The Sarre. 3. Coalfields of the Central Plateau.

The largest coal field of France is in the north-east and is in fact the western end of the Belgian coal field. The richest area is round Lille which makes linen, woollen and cotton goods. Roubaix, close to Lille, makes woollen goods, but the chief centre of the cotton manufacture is Rouen on the Seine, far from the coal fields. This town however, is very conveniently placed for [illegible] and English coal. The damp climate of the place together with easy facility for transport by rail, river and steamship lines, has localised the cotton industry in this port and it is often called the Manchester of France.

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The Southern coal fields of France are on and around the central plateau, and they are very small. The only field of any importance in this region is near St. Etienne, where silk, ribbons and iron goods are manufactured. Another important manufacturing centre near this field is Lyons which specializes in silks.

RUSSIAN FIELDS.

It has been just now seen that though Russia is very fortunate in having rich deposits of both coal and iron yet the coal and iron fields in Russia are not in close proximity to one another. But both in the neighbourhood of Tula in the centre and in the Donetz district in the south, there are iron-ores of considerable importance and consequently iron industries have developed at Tula as well as in the Donetz and Dnieper districts. Tula is now trying to specialize in the manufacture of arms. Smelting work is largely done in the Donetz and Dneiper districts, and an iron industry producing many kinds of iron and steel goods is improving rapidly in the same region. In the central coal field manufacture has become quite important in and round Moscow. Cotton, woollen, and leather goods are made there.

We have so far devoted our attention to the study of the important coal and iron fields of Europe and the United States of America and the industries that have sprung up in connection with them. There are, of course, big deposits of both coal and iron in other parts of the world, but they are not yet so extensively developed. For instance there are huge deposits of both minerals in China but they are very little worked. In fact, China is possibly richer even than the United States of America which at present occupies the first

place in the world as a coal and iron producer, but her resources are still undeveloped. So we shall remain satisfied with a brief review of the other parts and some more detailed notes on India.

CANADIAN FIELDS.

After the United States of America the Dominion of Canada is the largest possessor of both coal and iron in America. In some places the two are found very close to each other and consequently an iron industry is developing there. The chief obstacle to the progress of this industry is lack of population. The land is cheap and cultivation is so profitable that the people have not, as a rule, turned seriously to manufactures and coal mining. Rapid development is now taking place. Coal is already mined to some extent in New Brunswick, Nova Scotia, and Cape Breton island in the east; near Banff in the Rocky Mountains and in Vancouver Island in the west. Moreover, there are large deposits of coal practically untouched in Newfoundland, under the plains west of Manitoba, and in Queen Charlotte Islands.

Iron is mined near the coal in Nova Scotia and Newfoundland and consequently a promising iron industry has been established at Sydney in Cape Breton island. Iron-ore is also raised in many other places but the largest deposit is near Michipicoten on the east shore of Lake Superior.

MEXICAN FIELDS.

There are also large deposits of both coal and iron in Mexico, but they have not hitherto been worked. Brazil is also extremely rich in minerals, but mining and manufactures are yet undeveloped there owing to lack of population and the difficulty of transport.

SOUTH AFRICAN FIELDS.

Only the Southern part of Africa is exploited to any considerable extent and there are several coal deposits in British South Africa. Coal deposits in Natal are very rich and they are mainly on the margin of the plateau. Newcastle is the centre of the collieries. Coal in the Transvaal is also abundant and is now mined principally east of Johannesburg. There are deposits of good coal in Rhodesia, but as yet are only worked to any extent at Wankie.

AUSTRALIAN FIELDS.

There are also both coal and iron in Australia, but except in New South Wales they are far removed from each other. The largest deposits of coal are in New South Wales. The chief collieries are in the Hunter River valley and in the Illawarra district south of Sydney. Coal is not only exported from Newcastle to the neighbouring States, but is sent to India, China, and South America. The coal of the Illawarra district is exported through Wollongong. Coal deposits of Queensland and Victoria, are respectively at Ipswich and in Gippsland. The coal of New Zealand is exported mainly through the ports of Westport and Greymouth.

CHINESE FIELDS.

There are large deposits of both coal and iron in Asia, but unfortunately they are not much worked. The largest deposits of coal are in China, India, and Japan, but, with the exception of Japan, manufactures have not made any very great advance in any of the countries of this vast continent.

China may even be the richest country in the world in coal and iron of first rate quality. Rich deposits of coal exist in many of the provinces of China proper and Manchuria, and the total amount is probably greater than that of the United States of America. The larger deposits are mainly in the interior and are as yet very little worked. There is a large deposit of anthracite coal near the bend of the Hwangho in Shansi, but it is almost untouched. The mines of Kaiping and Chenghsing in Chili province and of the Honan and Shantung provinces are the principal ones at present worked. The export of coal is not great except from the Manchurian mines at Fushun. The Chinese have no doubt the advantage of ample and comparatively cheap labour, but the inland situation of their coal deposits and want of transport facilities are the real causes of small export.

On the other hand, with abundance of cheap labour and rich iron-ore, China may later occupy a prominent place in the iron industry of the world and she has already made some progress in this direction. The one great centre at present is Hanyang; it draws its ore from the Ta Yeh mine which is 80 miles distant by water, and its coal from Pinghsiang (Kiangsi). All the rails for the Peking-Hankow line were supplied by Hanyang. The chief disadvantage of China is her lack of transport, for the rivers, with the exception of the main stream of the Yangtsekiang, are unfit for profitable navigation.

JAPANESE FIELDS.

Japan has several coalfields, but now that her industries have been developed the supply of coal is scarcely enough for her own needs. One field occurs in

the island of Kiushiu near the port of Nagasaki, which is also a coaling station. Other fields occur in the northern island of Hokkaido.

INDIAN FIELDS.

India, speaking as a whole, is rather deficient in coal. Though there are large deposits of iron-ore they are not close to the coalfields except in Bengal. Another defect is that her coal and iron fields are far from the sea excepting the important fields of Bengal which are from 150 to 160 miles from Calcutta. Most of the Bengal seams are bituminous and some yield good coke. In connection with this coal, local supply

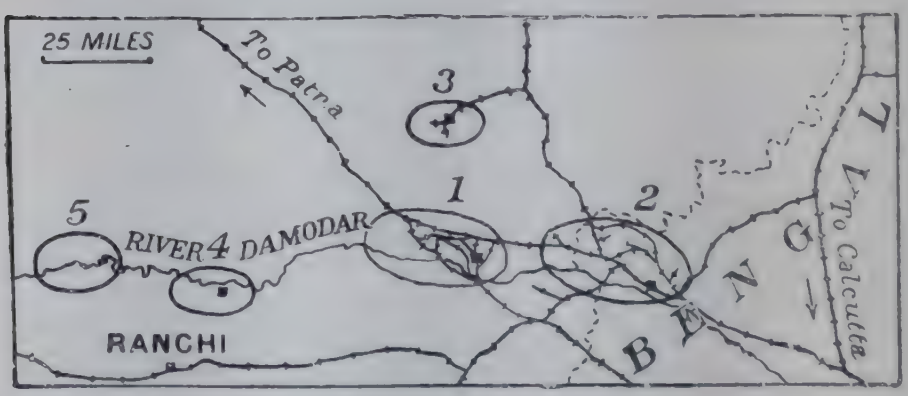

FIG. 52. THE COALFIELDS OF BENGAL AND BIHAR.
1. Jherria Field 2. Raniganj Field 3. Giridih Field 4. Bokaro-Ramgarh Field 5. Karanpura Field.

of jute, and cheap labour a good many big jute mills have been set up in the neighbourhood of Calcutta. The jute industry at Dundee in Scotland has suffered severely owing to the competition of Indian mills.

Most of the Indian coalfields lie in Bengal and Bihar. In 1903 six-sevenths of the total coal raised was from Bengal and in 1913 about 90 per cent. of the coal was raised from Bengal and Bihar. In 1923 the proportion was similar. Outside these two provinces the most important mines are those in Hyderabad

which yielded half a million tons or three per cent. of India's output in 1913, and rather more in 1923.

The chief coalfields of Bengal and Bihar lie east and west along the valley of the Damudar river. The easternmost of these fields, known as the Raniganj field, is nearest to Calcutta. It is joined by railways to Calcutta and was consequently the first to be mined. This field alone yielded 41.2 per cent. of the total production in 1903. The output in 1913 was 50 per cent whilst in 1923 it was still as high as 27 per cent. In this basin there are iron-stone shales lying between the Raniganj and Barakar coal deposits and they are used in the blast furnaces at the Barakar iron-works. The Jherria field is now a larger producer than the Raniganj field. It is connected with Calcutta by a branch line of the East Indian Railways. The output of this field was very steady. Both in 1903 and 1913 the total coal production of this field was one-third of the total production in India. In 1922 and 1923 it exceeded one half. The other Bengal-Bihar fields are in the district of Hazaribagh. They are at Giridih, Bokaro and Jainti and are joined by rail to Calcutta, Bokaro and Giridih being the most important among them. In 1913 the output of the Giridih field was 5 per cent. of the total coal production of India, in 1922 that percentage was produced by Bokaro.

Rich coal deposits lie in the Mahadeo section of the Satpura Range, on which the station of Pachmari is situated. In the neighbourhood of Mohpani in Narsinghpur District the coal was worked from 1862 to 1904 by the Nerbudda Coal and Iron Company and then handed to the Great Indian Peninsular Railway Company by which most of the coal has been consumed till now. The collieries near Warora are not

so important, but there are thick seams of coal to the south of Chanda near the Wardha river.

Outside Bengal the most important mines are those at Singarini in Hyderabad. The Singarini coalfield covers an area of 19 square miles. The principal seams worked are about 5 or 6 feet thick, but thicker seams are also being opened up gradually.

There are large deposits of coal in the valley of the Mahanadi and its tributaries. The deposits of Talcher, Rampur, Raigarh and Korba are in Bengal; there are also fields at Singurli, Sohagpur, and Umaria in Central India beyond the limits of the Mahanadi valley. Only the Umaria field is extensively worked. There is also Gondwana coal in the Darjeeling area and further east coal of later date in Bhutan and Assam.

Coal of Tertiary age is found in Sind, Rajputana, Baluchistan and in the east in Assam and Burma The most important field in Assam is at Makum.

Coal has however been worked with little success in the Shwebo district of Burma at Thingadaw. In 1902 the output reached 13,000 tons, but has rapidly declined and the field is no longer worked. There are thick coal seams of brown coal in the Lashio and Namma fields in the Northern Shan States and these fields are receiving attention owing to their nearness to Mandalay-Lashio Railway. Extensive deposits of brown coal occur near Kalewa on the Chindwin.

It has already been said that there are large deposits of iron in various parts of India, but in no places except Bengal do they lie in the neighbourhood of the collieries. Consequently iron-ore is mined on a large scale and smelted after the European methods only in the provinces of Bengal, Bihar and Orissa. Smelting on primitive methods is, however, done to some extent

in all provinces. Attempts to manufacture pig-iron and steel by European processes were first made in 1830 in the district of Arcot but were unsuccessful. The first successful attempts were near Barakar in Bengal. The site of the Barakar Iron Works was originally chosen owing to the proximity of both coal and iron-ore. For long the only source of supply of the ore was the iron deposits between the coal bearing Barakar and Raniganj stages, but now the supply of ore is mainly from the Manbhum and Singhbhum districts. The iron ore of these districts is very rich and extends even into Orissa.

The Tata Iron and Steel Company's works at Sakchi are now the largest and the most promising iron works in India. This Company possesses richer and purer ore in the Raipur district but now the supplies of ore are mainly from the deposits in Mayurbhanj. It not only manufactures pig-iron and steel but also rails. During the Great War, the Tata Iron Works supplied rails to the Indian Railway Companies and also cannon shells and other war requisites to the Government of India. In addition to these two large iron-works there are iron foundries scattered all over India, but excepting the railway and engineering workshops at Calcutta, Bombay, Madras and other large towns they are not of much importance. In consequence of the importation of cheap iron and steel from the United Kingdom and other foreign countries small smelting works on primitive methods are disappearing quickly.

WATER POWER.

We have dealt with coal and iron in the previous paragraphs rather elaborately, because they have so

long been the predominant factors in the localisation of industries. But now-a-days oil, natural gas and water-power are becoming more important in the field of manufacture. Of these three the use of water-power has become very important, because water-falls and rapids exist all over the world and water power may in course of time largely replace coal. The application of electricity to industries is becoming increasingly important and has produced great results. It has a tendency to prevent the localisation of industries on the coalfields or in their neighbourhood and to help in the establishment of industries in the places which have abundance of water-power. Mountainous countries with waterfalls and countries having many rapids in the rivers and rushing mountain streams, are therefore becoming rivals to the coal producing countries in the field of manufacture.

When we look at water-power we find the greatest development in the United States, but Canada, France, Norway, Sweden, Switzerland, Japan, Germany and Italy have all taken advantage of their resources.

The water-power may be used directly for driving machinery and indirectly for generating electricity. Electricity is often obtained from falling water by means of a machine called an electric dynamo. Again an engine driven by coal, coal gas, or oil with the help of the electric dynamo may also produce an electric current. This electric current is used in various ways; it is used for heating purposes wherever coal was formerly used as well as for lighting purposes and in driving machines. The current may be transmitted through a wire for many miles at a small cost and so machinery may be made to work at places very far from water power, coal, oil or gas. In course of time, when methods of transmitting electricity are im-

proved and there is less loss of power, there will be a rapid movement towards decentralisation, *i.e.*, the manufacturing regions will be widespread rather than concentrated in small areas. The great power of the Niagara Falls is employed to generate electricity and is transmitted by means of wire to light and supply power to many neighbouring towns. Towns up to 200 miles away use electricity from Niagara. Already

Photo. L. D. Stamp.

Fig. 53. Niagara Falls.

Niagara has been developed to the capacity of over 1,000,000 horse power and much more is under contemplation. When this fall is fully developed, it will be sufficient to drive all the factories along the shore of Lake Ontario; a portion of its power will also be transmitted to distant cities. Even in Germany, which has abundance of coal, the Falls of the Neckar have been employed to light the city of Frankfort

FIG. 54. THE NIAGARA FALLS POWER SCHEME.

Notice how the water is taken in above the Falls and taken down the Power Canal to the power house at Queenston.

which is 108 miles from the falls. In California hydro-electric power has been developed along the Sierra Nevada and transmitted 150 miles away to San Francisco. In the same way the Chaudiere falls are used in the timber industry of Ottawa (Canada) and the Mount Bischoff cataract in the tin industry of Waratah (Tasmania).

In France water-power is used on both slopes of the Vosges for the manufacture of cotton goods and in the valley of the Isere for the making of boats, because in both districts coal is difficult to obtain. Again water-power from the Rhone at Lyons and from the Loire near St. Etienne is employed to supplement steam-power. Though Switzerland has no coal, her mountain streams supplying water-power in abundance make up for this absence of coal, and the manufactures of the country are carried on mainly by water-power and by hand. The water-power is also applied to transport; many of the Swiss railways are electrified. Scandinavia like Switzerland is also lacking in coal and only a quarter of its iron-ore is smelted with the help of charcoal. The disadvantage caused by the absence of coal is somewhat removed by existence of enormous water-power in the country. The mechanical power for manufacture is already obtained to a large extent from the highland streams and there is a further possibility of the development of water-power for many purposes including railway transport. Now it is extensively employed in the saw mills and in the other mills where wood is pulped for the manufacture of paper and in the manufacture of matches and boxes. The entire absence of coal in Norway makes waterfalls of great value, and there is immense possibility of such use. The Fall of the Seven Sisters on the Geirangar Fiord will be, when

developed, of great importance to Norway, but now it is unused. In course of time the Norwegians may become a manufacturing people of the greatest rank with the help of the magnificent water-power which they possess.

In Italy, as a result of the lack of coal and other minerals, manufactures were of little importance in the past, but now in consequence of the recent development in the utilization of water-power from the Alps and the Apennines manufactures are becoming important and the chief industry to benefit is that of silk. The water power from the mountains is also being employed in Spain in the manufacture of iron goods.

PETROLEUM OR MINERAL OIL.

Besides water-power and coal, oil is also at present used in running factory machinery, and oil engines are used in factories, in ships and on railways. This has created a tendency to decentralise manufactures, for oil can be easily taken by pipes to a great distance at a very small cost. The manufacturers can now set up their factories in places far from the regions where the oil is obtained. The use of oil on railways and in ships is very convenient, for a less weight of oil than coal may serve the same purpose and the oil can be easily conveyed to railway trucks or to boats by pipes. The winning of mineral oil has become of tremendous importance in recent years. The United States and Mexico produce more than four-fifths of the world's total. Other important producers are Russia, Persia, Rumania, Venezuela, Dutch East Indies and Burma. India produces less than 1 per cent. of the world's total though Burma alone yields nearly 300,000,000 gallons yearly.

Photo. A. E. Day.

FIG. 55. OIL WELLS, YENANGYAUNG, BURMA.
(From Stamp's 'A First Geography of Burma.')

OTHER MINERAL DEPOSITS.

In this chapter the distribution of coal, iron and oil in the world has been discussed mainly in reference to the localisation of industries. There remains for us to consider briefly the distribution of certain other important mineral products.

In general, deposits of the ores of metallic minerals are found in the old, hard rocks which make up the great mountain chains. Consequently, many of the great mining districts are far removed from the normal haunts of man, and away amidst mountain fastnesses. In some parts of the world the masses of old rock have been worn down almost to sea level and there the mineral deposits may be found in the lowlands (*e.g.*, Eastern Canada).

Summarizing, the great mining regions of the world are found either along the great mountain chains such as the Andes, the Rockies and the smaller chains of Europe, or in worn down areas of old rocks such as the plateau of Peninsular India and the great Canadian Shield.

Copper.—Copper ore occurs abundantly in many of the Plateaux regions of the Andes and Rocky Mountains so that the Rockies of the United States and Mexico yield a third of the world's supply. Other important producers are Japan, Spain and the Belgian Congo.

Zinc.—The three great zinc producing countries are the United States, Australia and Germany. In the United States most of the supply comes from the Joplin mines of the Ozark Highlands.

Aluminium.—Aluminium is a very light and at the same time a very strong metal. It is abundant in many parts of the world, but nearly the whole world's

supply at present comes from the United States, France and Italy.

Tin.—Tin is a valuable metal which is required for mixing in small quantities with other metals, especially iron, to make the familiar "kerosene-tins" and smaller tins which are used in canning fruit, meat, biscuits etc. The sheets of metal of which they are made are called "tin-plate." Three-quarters of the tin of the whole world comes from South-eastern Asia—Malaya, Dutch East Indies (islands of Banka and Billiton), Siam, Lower Burma and China. The other producing ocuntries are Nigeria and Bolivia. Notice the large proportion produced by the British Empire.

Lead and Silver.—Lead and silver are often found together, and in many parts of the world. The important workings in the world are along the Andes and Rocky Mountains (Chile, Bolivia, Peru, Mexico and the United States—all noted for silver) and amongst the old rocks of Canada, Australia and the countries of Europe. Burma is now an important producer from the huge mines of the Burma Corporation at Namtu.

Gold.—Half the gold in the world comes from the Witwatersrand in South Africa—part of the British Empire. Other big producers are Canada, Australia, the United States and Mexico. Notice that the British Empire produces three quarters of the total, including some from the Kolar Goldfield of Mysore.

GENERAL CONSIDERATIONS.

It is evident from what we have just now seen that industries, even in modern times, very often gravitate to the coalfields. The reason for this concentration, we have seen, is quite simple. In most cases it is more convenient and less costly to carry raw materials

to the place where coal is found than to carry coal to the region where raw materials abound.

Though the consideration of coal, water-power, oil and natural gas is now-a-days very important in the selection of sites for factories, yet raw materials, climate and local demands have a great deal to do with their situation. This is especially the case now that electricity can be carried to great distances from the source of power. The industries which require bulky and less valuable materials in large quantities will generally be started in the places where the raw materials are found in plenty. The reason for such location is that the cost of transport of the raw materials would add damagingly to the cost of the finished articles. It is frequently observed that places with an abundant supply of timber have big lumbering industries. For instance, Scandinavia has large coniferous forests which yield plenty of good soft timber. This timber is very valuable for making packing boxes and in the manufacture of matches.

Canada, too, has an abundant supply of timber in its eastern part, and in the St. Lawrence basin. As transport is easy she has developed a very large lumber trade. Ottawa is the chief centre of the industry. Here saw-milling and the manufacture of paper from wood pulp are very extensively carried on. Though Siberia possesses a much larger forest belt yet she has not made much progress in this direction. The real reason for her backwardness is that she has not the wonderful waterways, water-power, and other advantages of Canada. The Siberian rivers as they empty themselves in the cold Arctic Ocean are of no use for commerce. The mouths of those rivers are ice-bound for nearly nine months of the year; in their upper courses, they are full of rapids; they are navi-

gable only in their middle courses. Besides, the Siberians are not industrious and advanced like the Canadians.

For nearly similar reasons wine-making is an important industry in Southern Europe. Nowhere in the world is the vine so largely cultivated as in Iberia and France. Grapes cannot stand long travel. Some of them are, certainly, dried into currants and raisins; some are sent abroad in very carefully packed boxes. But very large quantities of grapes are used in the making of wine. France makes Champagne, Claret and Burgundy, and Iberia manufactures Port and Sherry. Italy, Northern Africa, Cape Colony, South Western Australia, South Australia and Victoria each grows the vine and manufactures wine.

We have also seen that grasslands which support sheep and cattle in large numbers are the chief centres of the pastoral industry and dairy-farming. Leather also is an important industry there, if tanning material is available. Quebec in Canada has become a great leather market in connection with its forest of hemlock spruce (for tanning) and the supply of raw skins and hides. The leather industries of Christchurch and Dunedin depend on the sheep farms of New Zealand and the neighbouring forests which grow birch, the bark of which is an important tanning material. Most likely Pietermaritzburg will soon be a great leather centre in connection with the plantations of black wattle near the pastures of the Natal uplands. So also deposits of salt in the neighbourhood of coal often lead to the development of a chemical industry. St. Helens, on the Lancashire coalfield, near the Cheshire Salt area has a large chemical trade. Glass is made of sand and soda or potash. The chemical trades of St. Helens and Newcastle have, therefore,

led to the development of glass manufacture in both those places. In the same way abundance of the potash of the beech and pine forests, and of colouring materials, such as silver, copper or cobalt and the easy transport along the Elbe have made Bohemia famous throughout the world for its ornamental glass. Hundreds of similar examples may be added to show the influence of the supply of raw material on the origin and development of industries.

The influence of climate on the development of industries has already been noticed. Tropical conditions are usually unfavourable to manufactures on a large scale, for continued and hard labour is almost impossible. Intense heat tells greatly on the nerves of the people, who become lazy, nerveless and unambitious. Temperate conditions are, on the other hand, very invigorating and the people are, therefore, hardy and industrious. So we find that the great manufacturing nations of the world, have their homes in the temperate parts of the world. Besides the general influence of climate over manufacture, it has a very great influence over particular industries. A humid climate, we have noticed, is essential for textile industries, especially of cotton and linen. It is the moist climate of Lancashire which has localised cotton spinning and weaving there. If the climate is dry, the thread breaks frequently. For instance, on the Nottinghamshire coalfields, where the climate is too dry for close weaving, cotton hosiery goods are made. The textile industries of the United States are centred in Massachusetts on account of its humid climate. For similar reasons the textile industries in Germany, too, are mainly confined to Westphalia and the Rhinelands which are exposed to the moist winds from the Atlantic.

Dry climate, on the other hand, is essential for flour-milling. Minneapolis, St. Louis and Rochester in the heart of the United States of America have important flour-mil's. They are sufficiently far removed from the sea to have the required dry climate. Besides, they are in the wheat belts of the United States and have, in consequence, a copious supply of grain. The Mississippi is navigable up to St. Louis and the other towns are on the Transcontinental lines. So there is easy transport by river, rail and canal. For nearly the same reason Budapest is one of the most important flour-milling centres in Hungary.

The influence of water on the localisation of industries is no less important. Some industries depend to a large extent on the quality of the water supply. For instance, water which has a small quantity of gypsum in solution is excellent for the brewing industry. Brewing has, therefore, been developed at Burton, Edinburgh and Dublin which have all a plentiful supply of water containing gypsum. Bleaching and dyeing are very important processes in all textile industries and for this soft water is needed. The linen industry has become very important in Ulster, because of the good water supply and the flax locally grown. The silk industry in Cheshire, Derbyshire and Staffordshire owes its prosperity to the unfailing supply of pure, soft water. The cost of transport for the supply of raw material is not very important in this industry for the value of the finished articles is too high to have an appreciable affect on the cost of production.

Though we have so long refrained from saying anything about labour, yet labour is a very important factor in all industries. This is evident from the fact that labourers are constantly being taken from the most populous parts of the world to the New World

which still has a scanty population. This shortage of labour is retarding, to a great extent, the progress of Canada, Australia and various parts of South America.

The southern parts of Canada, especially the regions round the Great Lakes, resemble the United States of America in almost every respect. There is plenty of water-power, coal and iron necessary for manufactures. There is also easy communication by rail, canals and rivers. Rich deposits of coal and iron exist in Nova Scotia and Cape Breton island near navigable water and the climate is also suitable to factory work. Though the two countries are similar in so many respects yet they are on altogether different footing with regard to many manufactures. The reason for this difference is not far to seek. Large parts of Canada are even now thinly peopled. The present population is too small even for the development of her natural resources. Her manufactures are, therefore, still few and the energies of the people are taken up in preparation of raw materials for export and in the making of agricultural and other implements required on the spot. The dense or increasing population of the United States, on the other hand, has driven her to various profitable industries.

Number of population, as we have seen just now, is no doubt very important in the development of the resources of a country, but the energy and inventiveness of the people are still more important. It is upon the cheapness of labour that the cost of production mainly depends. By cheap labour we mean efficient labour and efficiency depends on cleverness and application. It does not depend so much on the actual wages paid to a labourer, but upon the quality and quantity of the things produced. As for example, a Chinese carpenter at a higher wage is rather cheaper

to a cabinet-maker than an Indian or a Burman with lower pay, for the former does almost double the work done by the Indian or the Burman. For the same considerations a European mechanic drawing double salary is often cheaper to an Engineering Company than an Indian or a Chinese.

But with regard to unskilled labour number is more important. Monsoon lands with dense population are therefore in an advantageous position in the production of commodities which require much manual labour. For instance, in the production of tea a great many persons are required to collect and dry the leaves, and do other work in connection. Much skill is not called for in such work. Hence no other countries are likely to be the serious competitors of India and China as far as the production of tea is concerned. The laborious cultivation of rice, where transplanting from nurseries is involved, is another example.

In most cases where things are made by hand great skill is called for, and skill is very often the result of much practice. India is even now noted for its hand-made muslin, silk, embroidery and shawls. Burma has been noted from early times for wood-carving, ivory-carving and bamboo-lacquer work. They are all excellent specimens of the arts. The Chinese, too, are noted for their handicrafts; their porcelain and silk are famous throughout the world. This skill is to a large extent hereditary. A weaver's son learns the art of weaving almost unconsciously and naturally just as a boy picks up his mother tongue unconsciously and without effort. Nearly in the same way a carpenter's or a potter's son picks up his father's craft.

A certain amount of skill is not only essential in the production of handicrafts, but it is indispensible in the making of all things. In spite of the invention

and application of labour saving machinery in almost all kinds of industry, a great many labourers are absolutely necessary in all industrial centres. They are mainly required for working and controlling machines, and this kind of labour is quite skilled; even here the skill is, no doubt, the result of experience. Wherever an industry has long been established in a particular locality there the workers become masters of their trade. This is one of the reasons why a particular industry tends to centralise in a particular region and acquires a name which exists for ages. A comparison of the woollen industry of Victoria in Australia and Yorkshire in England clearly shows the advantages of early start and long experience. Victoria possesses plenty of soft, long-stapled wool, and rich deposits of coal. Besides her humid climate is suitable both for spinning and weaving. Geelong, indeed has one immense advantage over Leeds; there is a plentiful local supply of wool. In spite of this local supply of lustrous wool, Geelong is far behind Leeds, because the industry in the latter town is very old and as such has earned a reputation and acquired a finish which counts much in all trades and industries. Geelong may, however, become in course of time a formidable rival of Leeds, when the Victorians have had more experience in the industry.

CHAPTER V.

Water Transport.

We have just now seen that in all ages the most essential things for manufactures have been a supply of raw material and labour. Every thing was done in early days by hand, and people were held in respect for their skill in handicrafts. A supply of raw material then gave rise to an industry centred as near as possible to the source of production. Some time afterwards, water-power and wind-power supplanted hand power to a very large extent, and factories were set up in places where water-power or wind-power was obtainable and the raw materials, too, were not very far off. Later, the employment of machines, and the use of steam-power in driving them, revolutionised industry. Coal was the chief fuel used in generating steam, and factories in most cases were transferred to the coalfields. In recent years the use of water-power and electricity is preventing this tendency to restrict the localisation of factories near the coalfields.

As large quantities of raw materials are needed to feed the factories, the raw materials have to be taken from places where they grow or are found naturally. So we find that three essential things for modern manufactures are (1) unfailing and regular supplies of raw materials, (2) cheap power, *i.e.*, coal, oil, or water-power and (3) labour, both skilled and unskilled.

The first condition necessitates easy and cheap methods of transport. It is not only absolutely necessary for the progress of manufacturing industries but for all other industries as well. Had there been no easy communications in Canada, the Canadian farmer

would have had no incentive to be so actively engaged in the production of wheat and oats, for in Canada these cereals are mainly grown for export and much of the land under cultivation would not have been cleared and tilled at all. In that case, the shepherds and herdsmen too, like the cultivators, would have been inactive and idle. Her lumberers and miners would have no stimulus for exertion and Canada would have been as backward as Eastern Siberia.

Similarly there would not be such extensive cultivation of wheat in the irrigated areas of the Punjab, and in the United Provinces, if they were not served by railways which carry the wheat to the nearest ports of Karachi and Bombay for export to the British Isles and other places which stand in need of it. The most important thing to be remembered here is that all commodities—agricultural, pastoral or industrial—are produced for market, and easy communications extend the areas which can be reached by the commodities of a particular centre. The greater the area, the larger would, under normal circumstances, be the demand. The greater demand means prosperous industry.

Now communication is either by water or by land. As the former is much cheaper than the latter, it is to be preferred. The reason for this cheapness is that the same power can move a greater weight through the water than across the land. Besides there is no cost of making and repairing routes, though expenses are incurred in the provision of harbours and of guarding the routes by light houses. The minimum rates are generally on the long ocean routes where the largest vessels are employed and the maximum on short and intricate river routes where small vessels have to be used.

Recent improvement in the build and speed of steamers, marvellous improvement in the process of preserving perishable commodities and speedy increase of the number of direct steam-ship routes have produced a great change in the markets of the world. Half a century ago, the meat supply and the dairy produce of the world were either from local markets or from some neighbouring foreign markets. Formerly Great Britain had its supply of meat, butter and cheese mainly from the local pastures of Devonshire, Cornwall, Wales and Cheshire and from Denmark. Holland, Scandinavia and other neighbouring continental countries. Now by cold storage, Australia, New Zealand, Argentina and the United States of America send large cargoes of meat, cheese, and butter to Great Britain, thus entering into competition with local pastoral industries and the continental countries.

In the same way a great change has come about in the fruit markets. Sometime ago, Mediterranean lands were the principal sources of the supply of fruits to the European markets and Great Britain had its supply of fresh fruits principally from them. Recent improvements in the art of preservation have considerably widened the areas of fruit supply. Refrigeration and preservation in air-tight vessels allow British Columbia and Ontario in Canada, California and Florida in the United States of America, Cape Colony in South Africa, South-Western Australia, South Australia and Victoria in Australia as well as New Zealand to send fruits such as apples, plums, oranges and lemons to Great Britain and other centres of dense population in which there is a great demand for them. Though Southern Europe is still the largest market for fresh fruits, yet the influence of the new fruit-growing places just mentioned on the world supply of these

commodities is being felt everyday more and more. Ever increasing speed of ocean going vessels and improved methods of production and preservation are, as it were, annihilating time and distance, making all parts of the world closer and nearer than they were before. Since the carriage of butter from Halifax (Canada) to Glasgow costs only $\frac{1}{4}$d. a pound, Halifax to the trader in butter is nearer to Glasgow than Ayrshire. Again when the cost of transport of a lamb from Christchurch or Dunedin in New Zealand to London is $\frac{3}{4}$d. a pound, the New Zealand ports are nearer to London than the Westmoreland farm. Geography has, in this sense, become the ' Science of distance measured in time and money.'

To make sea routes as short as possible and so to save time and trouble several ship canals have been constructed. Among them the Suez Canal and the Panama Canal are the most important. The Suez Canal was opened on the 17th November, 1869. It has considerably shortened the voyage to India, Australia and other places in the East from the ports of Western and Southern Europe. It was mainly instrumental in reviving the Mediterranean ports which dwindled to a remarkable extent after the discovery of the Cape Route in 1498, when much of the traffic in the Mediterranean was transferred to the Atlantic. The partial control of this Canal is of great strategic value to Great Britain which also exercises important influence over the destinies of Egypt and India. Recent acquisition of mandates over Palestine and Mesopotamia has redoubled its importance to Great Britain.

What the Suez Canal is to Great Britain the Panama Canal is to the United States of America. It has established direct connection between the Atlantic

and the Pacific. It has been opened to commerce since the 1st of August, 1914. It consists of three parts; a central lake formed by damming a small river, and two canals leading from the Atlantic and the Pacific to this lake. It is owned and controlled, with certain restrictions, by the Government of the United States. The Panama Government has surrendered the right of sovereignty over a strip of land 10 miles wide extending across the Isthmus. This forms the Canal

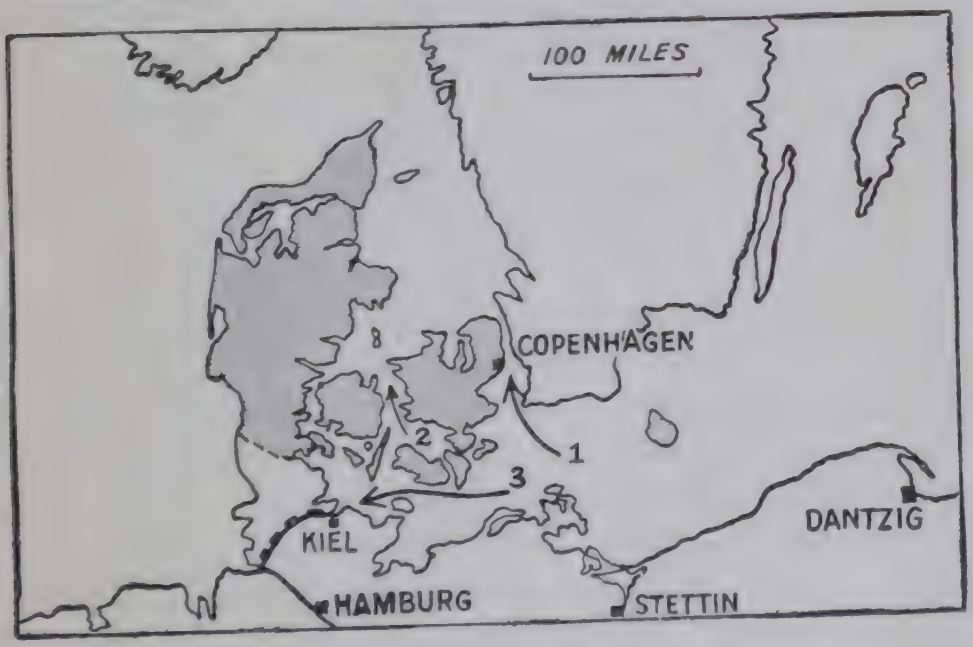

FIG. 56. THE KIEL CANAL.

Zone. The importance of this Canal to the United States, both from the strategic and commercial standpoints, is incalculable. It will enable the Atlantic fleet of the States to join the Pacific and *vice versa*.

From the commercial point of view, too, the advantages to the United States far exceed those to any other countries. The Panama Canal has shortened the water distance from New York to San Francisco by about 8,415 miles. New York is now about 2,400 miles nearer to Sydney than Liverpool.

What the Panama Canal is to the United States so the Kiel Canal, on a smaller scale, is to Germany. It joins the North Sea and Baltic Sea and allows free movement of the German fleet. This Canal is now, as a result of the last Great European War, open freely to all nations for trade.

As the carriage of goods by water is far cheaper than by land, many of the inland products, wherever possible, will be carried down the rivers to the ports at, or near, their mouths. For the same reason the things imported from abroad will be sent up from those ports to the inland centres for distribution. It follows that the ports at or near the mouths of rivers are both distributing and collecting centres. The boats employed in this service up and down the rivers are generally small. The rate of freight of the river navigation company is therefore, generally higher than that of the sea navigation company. Though the charge of river service is more than that of ocean service yet it is, speaking broadly, less than that of railways. It may consequently be supposed that this lower rate of freight will tend to drive away railways from countries where there is regular river traffic. In fact, however, this is never the case. Almost every important industrial centre or port is served both by railways and by steamers. Rivalry between railway and steamship companies, no doubt, to a certain extent keeps down the rate of freight, but it is nowhere acute enough for the steamer to supplant the railway. Rail transport is generally quicker and more regular than water transport and this compensates for the extra cost. Where there is facility for both traffics valuable goods and perishable commodities, such as fresh vegetables, will ordinarily be sent by rail whereas bulky goods and non-perishable cheap commodities will be sent by

steamer. In the case of valuable commodities, the cost of transport in comparison with their selling price is rarely so high as to be of prime importance. In the case of vegetables, quickness of transport is certainly a matter of urgent consideration, for time will deteriorate the quality and affect the prices. Moreover, they will even rot during the journey if too much time is taken. But with regard to bulky goods and imperishable goods of small value, freight (and not time) is the most important consideration. Merchants and traders will, therefore, try to avail themselves of water carriage whenever and wherever possible.

To secure this advantage of water transport in their internal trade almost all the commercially advanced countries have cut canals either to avoid rapids, cataracts and bores or to join the navigable rivers of one river basin with those of another. The canal systems of the Great Lakes and the St. Lawrence in North America exemplify the former and those of France and England, the latter. At present large steamers may reach Port Arthur and Duluth on Lake Superior and Chicago on Lake Michigan. The rapids between Lakes Huron and Superior are avoided by the Sault St. Marie Canal (Soo Canal), and those between Erie and Ontario by another canal whilst Lake Ontario is connected with the Hudson River and so with New York by other canals. The river Hudson is joined to Lake Champlain by another Canal and a river flows out of Lake Champlain into the St. Lawrence. The rapids on the St. Lawrence near Montreal are avoided by the Lachine Canal.

To facilitate internal trade almost all important rivers in France have been joined to one another by a marvellous system of canals. The South Canal (Canal

du Midi) connects the Garonne and the Mediterranean. It crosses the depression south of the central table land *via* the gate of Carcassonne. The Central Canal (Canal du Centre) runs through the depression south of the range of Cote d'Or and connects the Loire with the Saone, a tributary of the Rhone, and thus the Atlantic

Fig. 57. The Canals of France.

with the Mediterranean. The Rhine Canal leads through the Burgundian Gate—a depression which lies between the south end of the Vosges and the north west ranges of the Jura. It connects the Doubs, a tributary of the Saone, with a tributary of the Rhine, and thus the North Sea with the Mediterranean.

Although Canals are not so widely used in England as in France, England has an admirable system of canals which connects most of the important rivers with one another. The Leeds and Liverpool Canal joins the industrial districts of Lancashire and Yorkshire; the Grand Junction Canal connects the Mersey, Trent and Thames. The Kennet and Avon Canal joins the Thames to Bristol and the Berkeley Ship-Canal, Gloucester to the Severn. Many of the English Canals, such as the Kennet and Avon are falling into disuse, but of tremendous importance is the Manchester Ship Canal. The Manchester Ship Canal allows ocean-going boats direct access to Manchester.

It has been observed that the surplus products of a country, that is the things she has in excess of her needs, are generally sent to the nearest sea ports for export. It follows, therefore, that a country with a long coast line, broken and full of good harbours, is in a better position from a commercial point of view than one which has a regular coast line which is short in proportion to her area. The remarkable progress of the countries of Western Europe in trade and manufacture illustrates the advantage of long and broken coasts whereas the tardy development of the resources and trade of Africa exemplifies the evils of a regular, unbroken coast line. Since the prosperity of a country depends so much on the possession of good ports they deserve close attention.

The development of a port depends to a large extent on its situation. For a port to be of any importance it must stand on a river mouth, a lake, a bay or in some sheltered position where ships may lie at anchor safely even during storms. The first essential for a port is that it must be a good harbour. This presupposes that

the water in the harbour must be deep enough to allow the largest vessels to enter into it, if possible at all states of the tide. If ships are to wait for high tide it means a loss of time and money to the steamship company. If the water in the harbour is not deep enough for large vessels, small vessels (usually barges or lighters) have to be employed in the loading and unloading of cargoes. This additional cost of transport is sure to affect the prosperity of the port seriously.

It is no doubt a great advantage to a port to have water deep enough to allow even the biggest vessels to enter into and go out of it at all tides, but in fact few ports have this advantage. In a good number of ports vessels have to wait for tides. The ports which have regular high tides with a big rise may be called fortunate. Great Britain is fortunate with respect to its tides. The tidal wave which washes its shore comes from the south-west. On nearing its shore it divides into three branches. One branch sets up the English Channel, the second passes up the Irish Sea and the third branch passes to the westward of Ireland and Scotland. The latter after reaching the north-west coast of Scotland turns to the east and south-west, washes the eastern shore of Britain and meets off the south-eastern coast the tidal waters that rush up the English Channel. Thus at some ports along the coast double tides occur. There may actually be four high tides per day as at Southampton, or the period of high water may be prolonged for several hours.

Depth of water in the harbour is now more important than ever. The old sailing boats were small and therefore drew less water. They could go up the river many miles inland, and this was certainly an advantage, for it shortened the mileage of inland traffic which is more costly than ocean traffic. The use of big iron

ships has greatly affected the prosperity of these river-ports except in cases where the mouths of the river have been deepened. As big sea-going vessels cannot enter into these ports, new ports have to be built below the old ones and nearer the river's mouth and such "outports" are making rapid strides at the expense of the old river ports. For instance Puillac, St. Nazaire and Havre in France improved rapidly at the expense of Bordeaux, Nantes and Rouen. In Germany, Bremerhaven, Cuxhaven and Swinemunde made great progress at the expense of Bremen, Hamburg and Stettin respectively. In very much the same way Avonmouth is improving at the expense of Bristol, Tilbury at the expense of London, La Plata at the expense of Buenos Aires, Geelong at the expense of Melbourne.

In several places, to prevent the decay of old inland ports and reduce transit charges, the mouths of the river have been deepened and canals constructed to establish direct connection with the sea. It has been said that Rouen suffered considerably in the past much to the joy of Havre, but now the deepening of the mouth of the Seine is restoring its former glory. Cotton and other cargoes from the United States reach Rouen direct. In the same way the construction of Manchester Ship Canal allows direct trade between Manchester and the eastern ports of America.

It is important to remember that the size of modern steamers is, conversely, limited by the depth of water available at the ports. The largest steamers in the world ply between Southampton and New York, both of which have very deep anchorage. The size of vessels plying between Europe and India is strictly limited by the depth of the Suez Canal. Many of the great Atlantic liners could not pass through the Canal.

The Panama Canal, having been constructed more recently, is deeper.

Besides good anchorage and deep water a port must have easy communication with inland towns and all other collecting centres, so that it may continually be supplied with goods for export and the goods imported from abroad may at the same time quickly and conveniently be sent to the inland towns for distribution. This assumes that the land behind the ports must be rich either in natural or manufactured products; otherwise there will be nothing for export. Not only would a barren hinterland be unable to supply commodities for export but the population would be small and the demand for imports small. It follows then that an excellent harbour with deep water is not necessarily a large port. For example Greenland has many excellent harbours and the water at those harbours, is, no doubt, deep but as the island is ice-covered and barren and almost devoid of people there is very little trade. On the other hand a comparatively bad harbour with a rich and populous hinterland may thrive. Only the harbour has to be improved by expensive engineering works. Calcutta, the natural outlet of the rich Ganges and Brahmaputra Valleys is a good illustration. It is an inland port on a branch of the Ganges the mouth of which is being constantly filled up by the silt brought down by the river. Dredgers are always at work to keep the channel clear of silt. At the entrance into the river there are sand bars, and big steamers can reach it only during high tide. In spite of these defects it is the largest port in India and its position is second among the ports in the British Empire. Its nearness to the Bengal Coalfields and the local demand have given facilities for the growth of many important industries.

Not only is it very advantageous and profitable to improve bad harbours which have a rich hinterland, but it is also at times found necessary to construct artificial harbours. Madras, the capital of the presidency of the same name, is an illustration. It has no natural harbour and vessels used to anchor a mile or more off the shore, and land their cargoes and passengers by small boats, which were sometimes swamped by the waves. To make it a better place for anchorage

Photo. South African Railways Publicity Department.

FIG. 58. CAPE TOWN DOCKS FROM THE AIR.
A GOOD EXAMPLE OF AN ARTIFICIAL HARBOUR

breakwaters have been constructed at a huge cost. Madras now possesses a fine artificial harbour which can be used by large steamers at all states of the tide. Madras is moreover joined by four important railways with Bombay, Tuticorin, Calicut, and Calcutta. So we say a port to thrive must not only have rich lands behind it, but must also have easy communication both by rail and steamers.

A rapid comparison of Bombay and Calcutta may be found profitable. Bombay, the chief port of western India and the second in the Indian Empire, is not the natural outlet of the Deccan. It owes its importance to its position, good natural harbour, and the admirable railway systems which connect it with Calcutta in the east, Madras in the south-east, and Agra and Delhi in the plains of Northern India.

As Calcutta is the natural outlet of Northern India, Surat, on the mouth of the Tapti, is in the same way the natural outlet of the Central Provinces and the northern portion of the Deccan. It is probably for this reason and also for its position with regard to Delhi that it was the greatest port of India during the Mogul rule. But Surat has a shallow harbour which is becoming shallower, and, as the size of ocean-going vessels increased, so Bombay with its superior harbour replaced Surat. Now to come back to our comparison between Calcutta and Bombay the latter is neither fed by so many railways as Calcutta nor does it possess such an admirable inland communication by water. But it has two great advantages over Calcutta. It has a fine natural harbour and an excellent position with regard to its trade with London and other important European ports. Besides it is nearer to the high way of commerce between Europe and the Far East *viâ* the Suez Canal. In fact all important mails to Europe leave from this port and all mails from Europe are discharged here. It is, therefore, rightly called the 'Gate of India.' Its progress is also to a large extent dependent on the cotton industry which has sprung up in the city and in the neighbouring districts.

Though the prosperity of a port undoubtedly depends on the extent of its hinterland yet its

position with regard to the main routes to and from other parts of the World is a matter of prime importance. An examination of the rise and fall of the Mediterranean ports will be helpful in understanding this. Tyre, Carthage, Alexandria and Venice had their palmy days before the discovery of the routes *viâ* the Cape of Good Hope. They all lay in the track of commerce between the East and the West, and were the importers and dispersers of silk and muslin, spices, jewels and precious stones for which the oriental countries were noted. Soon after the route round the Cape of Good Hope was discovered, the ports of Western Europe, which began direct trade with the far East, went ahead of the rival ports on the Mediterranean, for the main paths of commerce were transferred from the Mediterranean to the Atlantic. They made progress at the expense of the Mediterranean ports and maintained their position until the Suez Canal was opened to navigation. The opening of the Suez Canal and the consequent transfer of the highway of commerce to the Mediterranean Sea has been a matter of great moment to the merchants of Southern Europe. But the discovery of the Americas and the rapid development of the resources of those wonderful continents have kept the ports on the western shores of Europe from decline and despite the partial loss of the eastern trade they have continued to progress. One important change has, however, taken place in the prosperity of the ports on the Mediterranean. Carthage, Venice and Alexandria have lost their former unique positions and their places have been taken by Marseilles and Genoa. The reason for this change is obvious. Marseilles, the port of Southern France has a very fine position with regard to its trade with other parts of the

Mediterranean and the East. Standing as it does on the Rhone Delta, it is the natural outlet of the valley which is connected by canal with the Rhine and the most developed regions of Continental Europe. Besides it is joined to the important towns of central Europe by rail. The opening of the

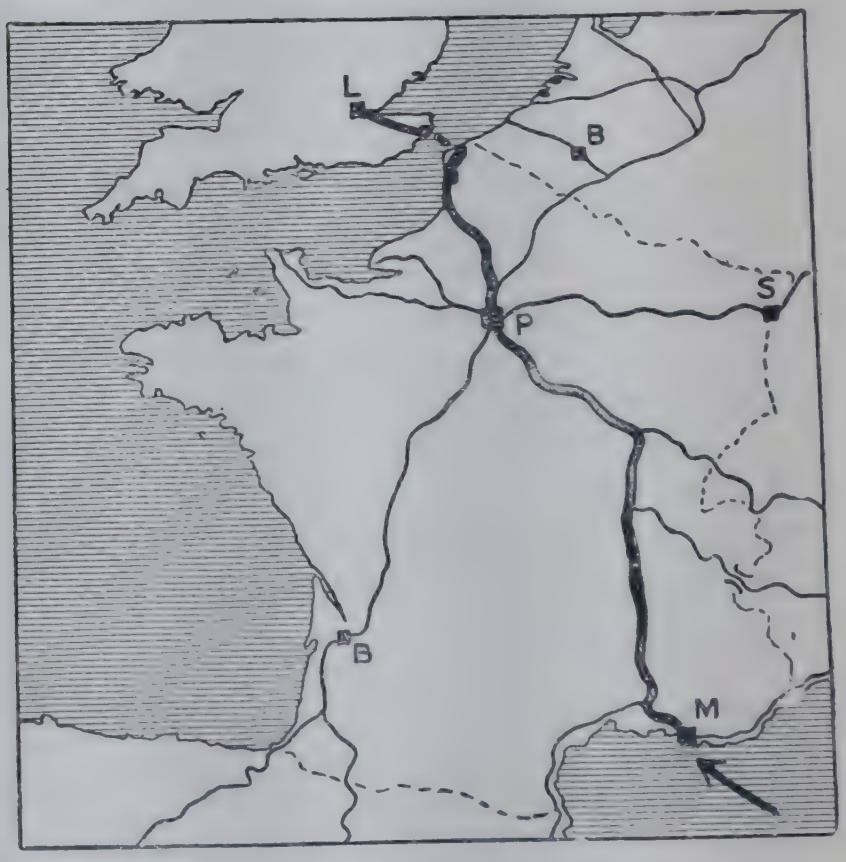

FIG. 59. THE RAILWAYS OF FRANCE. THE THICK LINE SHOWS THE ROUTE FOLLOWED BY THE MAILS BETWEEN INDIA AND ENGLAND.

St. Gothard Tunnel, through which the main railways run to Antwerp has, however, tended to reestablish the old and natural rivalry between Genoa and Marseilles.

For nearly the same reason Rangoon is the natural outlet of Burma, Karachi of the Punjab, Basra of

Mesopotamia, Beirut of Syria, Smyrna of Asia Minor, Shanghai of Central China, Canton of Southern China and Bangkok of Siam. In the same way in the New World: Montreal is the outlet of the St. Lawrence basin, New York of the Hudson-Mohawk basin and the interior, New Orleans of the Mississippi basin and Manaos and Para of the Amazon forests.

Besides the geographical factors already noticed, there are other things which govern the destiny of a port materially. Official regulations, for instance, often decide the fate. Though Fiume has no natural advantage over Trieste as a port yet it made some improvement at the expense of the latter. The reason for this was that the warehouse rent at Fiume was lower and the accommodation better, and the time allowed for goods to remain on the quay free of charge was longer. It is for official interference that steamers formerly could not compete with junks in the trade between Canton and Hongkong, because goods carried by steamers were subject to a tariff fixed by treaties whereas the goods carried by junks were not. Venice and Ancona lost their trade for sometime, because the Venetian authorities did not care to provide dock accommodation for merchant ships and the officials at Ancona allowed exorbitant charges for porterage.

Quarantine regulations affect trade exactly in the same way. Algiers is a more popular coaling station than either Malta or Gibraltar. This is mainly because the quarantine laws in the French port are not so strict as in the British. Algiers also divides the distance between Port Said and Great Britain better, and has a safer anchorage than Gibraltar. Moreover it gives greater variety of facilities to shipping and has better dock accommodation than the

British Port. The quarantine station of Algiers is on an island. Its insular position enables the detained passengers to have comforts which are almost impossible on board a ship. Wellington in New Zealand is fortunate, like Algiers, in having a quarantine station on Somes Island.

CHAPTER VI.

Trade Routes.

In ancient times there was a brisk trade between Europe and India. The chief imports from India were spices, silk, muslin and precious stones which could bear a costly transport. This trade was chiefly in the hands of the Arabs in the East and the Venetians and the Genoese in the West. The route was partly by land and partly by water. The Arabs carried their goods from India through the Red Sea or the Persian Gulf, unloaded the boats and took the cargoes across the land on camels to the Mediterranean. The Venetian and the Genoese merchants put them again on boats and landed them at European ports for sale. The chief emporiums of oriental goods were at Alexandria, Venice and Genoa. The merchants of Western Europe wanted to have a share in this highly profitable trade and sea-captains were sent out by different nations to discover a direct route to India all by sea.

The idea of reaching India by sailing westwards was first put to practical test by Christopher Columbus, who believed the world round and that India lay to the other side of the Atlantic Ocean. The King of Spain gave him three ships with crews and provisions. He set sail from Cadiz in 1492 and, availing himself of the North-East Trades, reached one of the islands of the Bahamas in two months. From there he sailed south and came to the island of Cuba. Some months after, he resumed his journey southward and reached Haiti. Columbus thought that a little way to the north must

lie a belt of westerly winds. So during his return journey he sailed northward from Haiti and availing himself of the westerly winds (South-West Anti Trades) came to Lisbon in about the same time he took in going to the West Indies.

Several more unsuccessful voyages were made by different nations to find out a sea route to India. Vasco da Gama was the first navigator to reach India. The King of Portugal supplied him with three ships and other necessary things for his expedition. He left Lisbon at the beginning of July 1497 and, with the help of the North-East Trades, reached the Cape Verde islands by the end of the month. Shortly after he had sailed southward he met the South-East Trades. As the winds blew against him, it took him more than three months to reach the Cape of Good Hope. Then he sailed east and north along the coast, and on the 1st of March, 1498, he reached Mozambique, the most southerly of the Arab trading towns on that coast. He found the Arabs hostile, for they were afraid that the Portuguese might break their monopoly in trade. He continued, however, his northerly journey, and landing on several stations on the coast went northward as far as Mombasa. He then turned eastward and, availing himself of the south-west monsoons, landed at Calicut on the Malabar Coast in less than a month. During his homeward journey it took him three months to reach Africa for the monsoons then blew against him. When he reached the south-east coast of Africa the South-East Trades took him to Cape Verde in a month. Beyond this Cape the North-East Trades blew against him and it took the fastest of his vessels two months and a half to reach Portugal.

It is interesting to remember how the winds accelerated or retarded the speed of the sailing vessels of the early navigators as they blew in favour of or against them. Though the sailing vessels are now almost entirely supplanted by steamers yet there are a few of them even now. They often move far away from the shortest route to avail themselves of the steady prevailing winds for, though the journey thereby becomes longer, it takes them less time.

Steamship Routes.

As Great Britain is in the centre of the land hemisphere and has the largest carrying trade in the world it is convenient to take it as the starting place of the great oceanic routes. They may be classified into :—(1) the North Atlantic routes, (2) Routes to the Panama and the West Indies, (3) the South Atlantic and Cape Horn routes, (4) the Suez routes and (5) the Cape routes. The other important routes are across the Pacific.

In the North Atlantic routes thousands of ships of all kinds are engaged in crossing and recrossing the Atlantic. The chief British ports engaged in this trade are Southampton, Liverpool, Glasgow, London, and Bristol and those of America are Montreal, Quebec, Halifax, St. John, New York, Philadelphia and New Orleans. The journey across the Atlantic generally takes from 6 days in the north to 8 days in the south. The chief imports to the British Isles from Canada are wheat, oats, timber, fish, butter, cheese, bacon, furs, hides, copper, and nickel. The imports from the United States are cotton, tobacco, wheat, maize, bacon, lard, meat and other animal products; petroleum and copper.

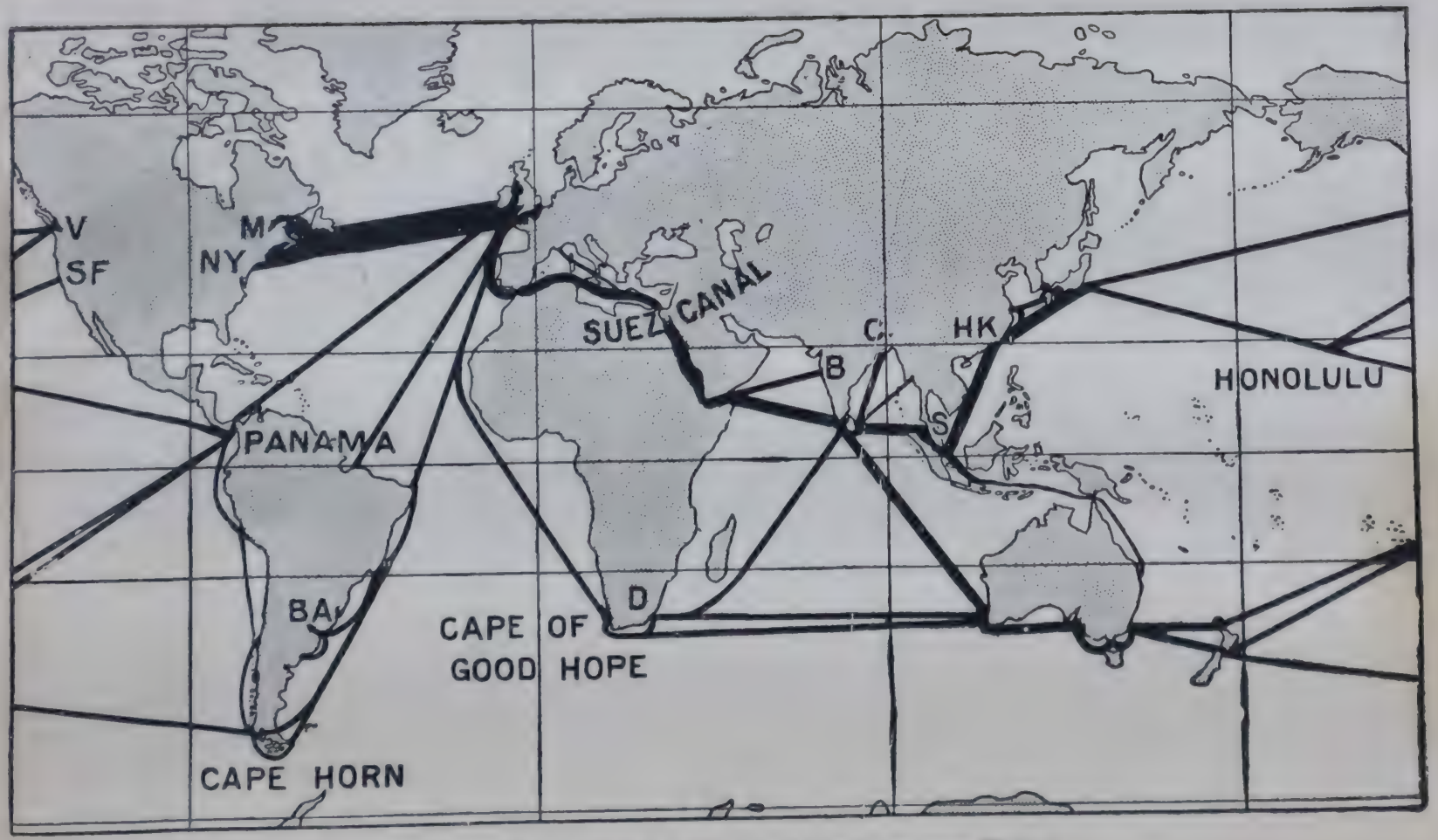

FIG. 60. THE PRINCIPAL OCEAN ROUTES OF THE WORLD.
Put in the names of all the ports marked by a letter.

The important British ports trading with the West Indies and Central America are London, Southampton and Bristol. On the American side the important ports are Kingston, Barbados and Colon (Panama). It takes about 17 days to complete the journey. The chief imports to the British Isles are tobacco, sugar, fruits, coffee, cocoa, sponges and spices.

The routes through the Mediterranean, Suez Canal, Red Sea and across the Indian Ocean to India, Burma and the distant China and Japan on the one hand and Australia and New Zealand on the other, are (after the north Atlantic) the most important oceanic routes in the world. It takes more than three weeks to reach Bombay by this route from London or any other port of southern England and about a week is taken to reach either Calcutta or Rangoon from Bombay by sea. To avoid this long journey and save time the English Mail follows a different route. Dover is 1½ hours from London by rail. Channel steamers take the mail across from Dover to Calais in about an hour. From Calais the mail is taken by rail to Marseilles in about 16 hours and thence by boat to Bombay in 15 days. The journey from Bombay to Calcutta by rail takes 38 hours and a half and from there the mail is brought to Rangoon in about two days and a half by the steamers of B. I. S. N. Company. Before the Great War, the mail steamers picked up the mail at Brindisi in Italy and not at Marseilles, but the Italian railway service is not so reliable as the French.

The merchants vessels bound for Calcutta, Rangoon, Singapore and northward to Hongkong, Shanghai and Yokohama as well as for Perth and the other ports of Australasia, follow the same course till they reach Colombo, the port and capital of Ceylon

From Colombo they take different routes. Those bound for Calcutta steam north and those for Rangoon north-east. Vessels for Singapore steer first to the east and then to the south. The steamers bound for the southern ports of Australasia, *viz.* Fremantle, Adelaide, Melbourne, Sydney or Dunedin, steam southwest whereas those for Darwin, Thursday Island, Cooktown, Townsville, Brisbane, Auckland and Wellington, steer more to the east and pass through the Sunda Strait. The chief imports to the British Isles from the Indian Empire are tea, jute, oil-seeds, wool, hides and skins, wheat, rice, tobacco, timber, hemp, silver, tin, indigo, coffee and other products. From Australia the imports are wool, wheat, gold, silver, meat, cheese, butter, tallow, hides and other animal products.

The chief ports of Britain trading with South Africa are London, Southampton and Plymouth; those of South Africa are Cape Town, Port Elizabeth, East London, Durban and Lourenco Marques.* The journey to South Africa is long and takes about 18 to 22 days. The African ports are also joined to the ports of the Indian Empire by steamship lines across the Indian Ocean. The chief imports to the British Isles from South Africa are gold, diamonds, wool, mohair, maize, hides and skins.

The main ports of Great Britain trading with South America are Liverpool and Southampton. On the American side the chief ports are Georgetown Paramaribo, Para, Pernambuco, Rio de Janeiro, Monte Video, Buenos Aires, Bahia Blanca and Port Stanley (Falkland Islands). This journey is very long and as the continent extends over 62 degrees of latitude the time taken to reach different ports on its coast from Britain varies considerably. The journey

* Lourenco Marques is in Portuguese East Africa.

to the southern ports takes three weeks. The chief imports to the British Isles from the northern half of the continent are coffee, cocoa, rubber, sugar, timber and other forest products and from the southern half are meat, wool, wheat, maize and other temperate products.

Considering the vastness of the Pacific Ocean the trade routes across it are relatively less important. The chief trade in the North Pacific is between south-east Asia, including Japan, and the western margin of North America. The most important ports of Asia engaged in this traffic are Hongkong, Shanghai and Yokohama and those of America are Vancouver in Canada and San Francisco in the United States of America. The distance from Yokohama to Vancouver and San Francisco is respectively 4,320 and 4,500 miles. To shorten the journey steamers from Yokohama bound for Vancouver proceed far more towards the north than Vancouver itself and avail themselves of a "great circle route."

In the South Pacific there is trade connection between Australasia on the one side and Canada, United States of America and Central America on the other. The chief ports in Australasia are Sydney, Melbourne and Auckland and those in America are Vancouver, San Francisco and Panama. Steamers to Vancouver and San Francisco generally touch at Honolulu in the Sandwich or Hawaiian Islands. Auckland in the North Island of New Zealand is also connected by steamship line with Panama. The Cape Horn route from Australia and New Zealand to Europe is much less important than formerly.

The question may arise, why should ocean steamers nearly always use these definite routes instead of going in all directions across the oceans? There are,

indeed, "tramp" steamers which wander about wherever they may be required to pick up or discharge cargoes, but the majority of steamers, both passenger and cargo, travel along fixed routes.

In the first place the main ocean routes are carefully charted, dangerous spots are marked by lighthouses, coaling stations where supplies of coal and fresh water may be obtained are scattered along the route. Further, a vessel in distress can easily summon help by wireless from vessels using the same route. Also much of the world's trade is comparatively constant and the same exports and imports tend to pass between the same two countries year after year, thus necessitating a regular service of steamers.

CHAPTER VII.

Transport by Rivers and Canals.

We have just now seen that transport by water is cheaper than transport by land, and that ocean transport has become more important now than it ever was, owing to the concentration of people in some countries in temperate latitudes where neither the food-stuffs are sufficient to feed the people nor the raw materials sufficient to feed the factories. What ocean traffic is to the trade between different nations river traffic may be to the trade between different parts of a country. River routes are sometimes almost as important for the internal trade of a country as ocean routes are for its external or foreign trade. The main difference is that on land railway transport is available also. There are countries like northern India, where the railways have almost completely supplanted the rivers. On the other hand the main arteries of certain countries—*e.g.* Burma—are still the rivers. The importance of river transport in the past is evidenced by the fact that the basins of large navigable rivers were the cradles of ancient civilisation. The Chinese civilisation had its birth in the plains of the Yang-tse-kiang, the Hindu civilisation in the basins of the Indus and the Ganges, the Babylonian and Assyrian civilisations in the basins of the Euphrates and the Tigris, the Egyptian civilisation in the valley of the Nile. Even now the importance of navigable rivers is very great. In fact a large percentage of big inland commercial and industrial centres are on large navigable rivers, because, as already stated, water carriage is cheaper and often more convenient than

carriage by land. A short review of the river systems of the world will make this point evident.

Let us begin with the examination of some important European countries. Among the European countries Germany is exceptionally fortunate in having large navigable rivers and to borrow the words of Lyde ' her rivers are as ambitious as her people,' for they all rise in places far beyond her frontier. What Germany lacks in coast line she makes up by her large navigable rivers, and probably in no other country are such big manufacturing and industrial towns to be found on river banks as in Germany. The Rhine, the largest river in Germany and the most important in Europe has perhaps the largest river traffic in the world. As one of the two tributaries forming the Rhine has its rise in a very big glacier which feeds it during the hot weather and as some of its tributaries glide down from the mountains were there is rain nearly all the year round, the river varies little in depth and volume of water and is therefore of incalculable value in navigation. If there be any great variation in depth and volume of a river it is not easy to provide warehouses, piers, waterside railways and other things for traffic. The Missouri, the largest tributary of the Mississippi, is not of so much use for traffic, because it varies greatly in depth and volume in different parts of the year. To come back to the Rhine, apart from natural advantages it has been greatly improved artificially. Sea-going steamers now land their goods at the river port of Cologne. It is navigable by big river steamers as far as Main and Mannheim and Strassbourg. The first stands at the place where the Rhine receives the Main and Manheim at its confluence with the Neckar. The Rhine is navigable as far as Basel on the Swiss

border by vessels of special make. The other big rivers of Germany are the Weser, Elbe and Oder. The Vistula, once a German river, is now the principal river of Poland and the port at its estuary, Danzig, is now under the control of the League of Nations. Konigsberg, the other port at its estuary, is in German territory. The rivers of Germany are also joined with one another by canals and have thus been rendered more serviceable for trade. The Elbe is not only navigable within German lands, but it is easily navigable from Prague (on its tributary the Moldau) in Bohemia. There are also important towns on the Elbe itself, *viz.*, Dresden and Magdeburg, as on the Rhine. At the head of the estuary is the port of Hamburg (with Altona), the largest German port. It is joined by a canal with Lubeck on the Baltic.

The Oder is also navigable for all the German part of its course. In its upper course it flows through the rich mining and manufacturing parts of Silesia. Breslau on its bank is the most important town in this industrial area. Frankfurt, at a bend of the Oder, is as important as Magdeburg on a bend of the Elbe. At a place just above Frankfurt the Friedrich Wilhelm Canal joins the Oder to the Spree on which Berlin is situated. The Spree joins the Havel which again joins the Elbe and so there is uninterrupted water communication from Upper Silesia through Breslau, Berlin and Hamburg to the North Sea. It is interesting to remember in this connection that, besides the Rhenish provinces, the chief industrial districts of Germany lie between the upper courses of the Elbe and the Oder. Like Hamburg, which stands at the head of the estuary of the Elbe, Stettin stands at that of the Oder. To this port goods may also be sent from Berlin up the Havel

and by the Finow Canal which follows the low water parting to the lower Oder. The Vistula turns to the north-east at Bromberg. The Netze which rises near this point is joined to the Vistula by the Bromberg Canal. Hence there is unbroken waterway westward by way of the Netze, Warthe and Oder and thence to Central Germany and the North Sea.

France, as we noticed in an earlier chapter, is not far behind Germany in providing inland waterways. She has some large navigable rivers but they, unlike the rivers of Germany, have their sources within France. The exception to this rule is the Rhone which rises in the Alpine lands of Switzerland. On the other hand, like Germany, she has improved some of her rivers considerably by deepening their beds artificially. Moreover, to secure through inland communication by water, as far as practicable the most important rivers have been joined with one another and with those of the adjacent countries by canals. The rivers are now navigable except in their uppermost courses. The Oise is connected with the Meuse, the Sambre and the Scheldt. The Marne and Rhine Canal passing through Nancy and the Pass of Soverne joins the Rhine with the rivers of the north-east France. From the same valley several canals radiate : the Burgundy Canal runs to the Yonne, the Canal du Centre to the Loire and the Rhone-Rhine Canal through the Burgundian Gate to the Rhine. Besides the Garonne and the Rhone are joined with each other by the Canal du Midi which runs by way of Carcassonne gate and Toulouse.

Russia, like Germany, has large navigable rivers running all over, but the chief defects of her rivers are that they either flow into inland seas like the Caspian or into the Arctic Ocean which is frozen over

in the winter and so closed to navigation. Moreover, the rivers themselves are all frozen in the winter and the largest of them all empties into the enclosed Caspian Sea. The main stream of the Volga rises in the comparatively low Valdai Hills and as the land through which it makes its way to the Caspian Sea is very level its current is very slow. As the Caspian Sea is a land locked sea this river offers no outlet for foreign trade. To make up this defect the construction of a canal through the place where both the Volga and the Don bend sharply towards each other is under consideration, but now the traffic from the one river to the other is by rail. In spite of this defect the Volga is most important for inland water traffic. One of its important navigable tributaries, the Kama, flows through the mineral district of Perm and is a great help towards the development of the mineral resources of the western regions. Another tributary, the Moskva, renders the same service to the industrial area round Moscow and Tula. The other rivers of Russia *viz.*, the Dwina, Don, Dneiper and Dneister are also of great service for the trade of the country. The last river is navigable only in its lower course.

The seaborne trade of Russia suffers as already noted because her rivers either flow into the Arctic Ocean which is dangerous for navigation for some months in the year and has no land on the other side offering facility for trade; or into inland seas like the Baltic and the Black which remain ice-bound during winter. Riga, the most important port for the flax and timber trade of Russia is at the mouth of the Dwina. This port however, is no longer in Russian territory but is now the capital of the new State of Latvia. The most important Black Sea ports are Kherson at the mouth of the Dnieper and Odessa.

The Danube, the second largest river in Europe, with its tributaries, is the only important means of water carriage to the people of the modern States of Czecho-Slovakia, Austria, Yugo-Slavia, Hungary, Bulgaria and Rumania. The trade of these States has a natural tendency, in consequence, to move to this river and many of the important towns, *viz.*, Vienna, Buda-Pest and Belgrade are on the main stream.

The importance of river traffic will be better understood if we direct our attention to the Iberian peninsula which is far behind the other countries of Europe both in trade and industry. One reason for its backwardness is its relief, which has rendered the rivers unnavigable except in their lower courses and which prevents rainbearing winds from reaching inland. The Ebro, which empties itself into the Mediterranean Sea, is navigable for a considerable distance from its mouth and therefore its basin is one of the most advanced regions in Iberia.

If we pass from Iberia to England and the low lands of Scotland we find that they are extremely fortunate in having navigable rivers rising in places very close to one another and thus giving every facility for unbroken water communication.

As we have already noticed, to afford water carriage to the industrial centres of the Midland counties of England several canals have been dug. The Leeds and Liverpool Canal crosses the Pennines through the low Aire Gap; the Trent is joined to the Mersey by a canal which runs *via* the pottery centre of Stoke. The Trent is also connected with the Thames by two canals; one runs *via* Leicester and Northampton and the other *via* Birmingham and Oxford. The Thames is also joined to the Severn by a canal, running *via* Oxford and Stroud.

In the same way, to give facilities for cheap water carriage to the most important industrial area of Scotland, a canal joining the Clyde to the Forth has been constructed. This canal runs from Grangemouth to Bowling through Falkirk. The other canals of Scotland, *viz*, the Caledonian Canal and the Crinan Canal have been cut for passenger steamers. The former runs from Inverness through the Glenmore valley to Fort William; the latter passing through the northern end of the Kintyre Peninsula makes a shorter passage for tourist steamers from the Clyde to the west coast.

The most important river systems of North America are those of the Mississippi and the St. Lawrence. As the sources of the Mississippi and the St. Lawrence are within a few miles of each other, easy communication between the two systems is rendered possible. The Missouri, Ohio, Arkansas, Red River and other smaller tributaries of the Mississippi drain the great central plain of the United States. The main stream is navigable for 2,000 miles from the ocean to the river port of St. Paul in Minnesota. The Missouri is longer than the main stream which it joins at St. Louis, the most important railway centre of the central plain. It is navigable for a great part of its course. So is the Ohio, which rises in the Appalachian Mountains not far from Pittsburg and joins the Mississippi some distance to the south-east of St. Louis, and therefore the two streams (Ohio and Missouri) together afford a great waterway communication between the east and west. The St. Lawrence is not so large as the Mississippi nor is it naturally as navigable but it is equally important for traffic despite the fact that its estuary remains ice-bound for over four months of the year. Its importance is due

to its passage through the most important lake system of the world and its rapid waterfalls are avoided by canals which we have already noticed. The lakes provide excellent waterways for both Canada and the United States and far more traffic passes through the " Soo " Canals than the Suez Canal. The St. Lawrence has near its estuary Montreal, the eastern port of Canada like New Orleans at the mouth of the Mississippi. The Mackenzie, like the St. Lawrence, passes through a series of lakes. The chief are Lake Athabaska and the Great Slave Lake. It then flows north to the Arctic Ocean. Although navigable for 2,000 miles this river is of little use for navigation; it passes through an undeveloped region into an almost useless ocean and is frozen for a great part of the year.

It has already been noted that the sources of the Mississippi and the St. Lawrence are close together and the two rivers are therefore easy to connect. The Mississippi has indeed been connected with the Great Lakes by several canals: one canal from Chicago joins Lake Michigan to the Illinois, a tributary of the Mississippi and another canal from Milwaukee joins it to the Wisconsin, another tributary of the same river.

The rivers of South America, like those of North America, form a network of waterways and enable much of the produce of the interior to be brought to the coast and thereby do incalculable service to the internal and external trade of the continent. The Orinoco which drains the grassy lowlands of Venezuela is navigable for 1,000 miles from the sea. The main stream of the Amazon is navigable for 2,600 miles from its mouth and ocean liners can reach Manaos, 1,000 miles from the sea. The high tide at

the mouth renders navigation somewhat difficult. The connection of the river with the Para Channel at the mouth of the River Tocantins gives a safe outlet Further, most of its tributaries, especially the Negro and Madeira, are navigable for a considerable distance. Manaos on the Negro near its junction with the main river is an important port.

The southern and most developed parts of South America are drained by the Parana, Paraguay and Uruguay which together form the estuary of Rio de la Plata. These rivers, flowing from north-west, north-east and north into the same estuary afford excellent waterways to the interior and have been very helpful in the improvement of these regions. As the sources of several tributaries of the Amazon are not far off from the sources of the rivers which form the La Plata it is quite possible that the Amazon system will in course of time be connected with the La Plata system.

The rivers flowing down to the west coast of the Continent are of little use for navigation.

The relief of Asia is so diversified and her land so vast that it is very difficult to make any general statement about the utility of her rivers for navigation. The rivers flowing into the Arctic Ocean are not of much use for navigation except in their middle courses, because their mouths remain ice bound for more than 9 months in the year and the land around their lower courses is of little use. On the other hand, they flow in their upper courses over rough and rocky beds.

Among the rivers flowing to the Pacific only the Yangtse-kiang is navigable far into the country. It is navigable for steamers for more than 1,000 miles from its mouth, but beyond that is impeded by rapids

before another stretch of navigable water is reached. Ocean-going steamers can go up this river as far as Hankow, one of the great inland centres. The river Yangtse, therefore, has great traffic which is concerned chiefly with domestic trade. Shanghai near its mouth is the largest port of China. The greater parts of the courses of the Hwang-ho and the Si-Kiang are impeded by rapids and the shifting channel of the Hwang-ho is a hindrance in its lower course. Canton, which stands near the mouth of the Si-Kiang, is one of the largest cities in China. The Imperial (or Grand) Canal connects the rivers flowing into the Gulf of Pechili with the mouth of the Yangtse and the plain through which it passes is one of the most densely populated parts of China.

The important rivers flowing southwards are the Mekong, the Salween and the Irrawaddy in Indo-China, the Brahmaputra, the Ganges and the Indus in India and the Tigris, Euphrates in Mesopotamia. They are all more or less navigable in the courses through the plains.

Among these rivers the Salween, the Irrawaddy, the Brahmaputra, the Ganges and the Indus, being mainly within the confines of British India, deserve our notice. Though the Salween has a longer course than the Irrawaddy yet it is not of much importance, because it flows in deep gorges from the Tibetan borders through the mountains of Yunnan and the Shan States and has rapids about 100 miles from the mouth. On the other hand the Irrawaddy, Brahmaputra, Ganges and Indus are navigable for long distances from their mouths and they have large ports at or near their mouths. The first river is navigable up to Bhamo near the Chinese border, (1,000 miles from its mouth)

the second up to Dibrugar in Assam, the third up to Hardwar at the foot of the Himalayas and the fourth to a little distance above Attock which stands at its confluence with the Kabul river. The Indus at its delta, unlike the Brahmaputra and the Ganges, is useless for the navigation of large vessels owing to shallowness and therefore Karachi, at the western end of the delta, depends for its traffic mainly on railways.

The source of the Indus is beyond the Himalayas in the lake region of Tibet, not far from the source of the Brahmaputra. The river runs a course of about 1,800 miles before it reaches the Arabian Sea. In its upper course from the source to the bend round Nanga Parbat, which is about 800 miles, it falls 17,000 feet and therefore its current is too strong for navigation. From the foot of the Salt Range, where it comes out of a gorge, to Hyderabad at the head of the delta it is easily navigable by river going vessels, but below this town it is difficult for navigation. As the tributaries which it receives on its right bank are all mountain streams, fed by snows, they are rapid and are of little use for navigation. The left bank tributaries of the Indus rise in the Himalayas and have long courses over the plains and are therefore of much use both for navigation and irrigation. As they pass through dry plains they decrease in volume because of the loss of water by evaporation and irrigation. Among the five tributaries which form the Panjnad the Sutlej is the most important. It takes it rise in Rakas Tal Lake, near the source of the Indus and together with the latter encloses a triangular piece of land which is the most important wheat growing region in India.

The basin of the Ganges-Brahmaputra system is by far the most important in India. It covers the whole

of Hindustan and the plains of Bengal and Assam. Unlike the Indus and the Brahmaputra, the Ganges rises in the Gangstri glacier of the Garhwal Range of the Himalayas and so is on the Indian side of the range. In the upper course the main stream is formed by the junction of the Bhagirathi and the Alaknanda, the latter being the larger of the two. The combined stream comes out of the mountains near Hardwar as the Ganges. From Hardwar to Goalundo the river runs through one of the most fertile and populous plains in the world and at Goalundo it is joined by the Brahmaputra. It has two sets of tributaries; the one set rising in the Himalayas to the north and the other set in the Vindyas and other hills to the south. The Himalayan tributaries, *viz.*, the Jumna, the Gogra, the Gundak and the Kusi, have a much heavier rainfall, and longer stages over the flat plain than the Vindya tributaries. Besides the Vindya tributaries are not fed by snow like those flowing down from the Himalayas. Therefore the Himalayan tributaries are much more useful than those flowing from the Vindya Range, both for navigation and irrigation. The most important right hand tributaries are the Chambal, the Betwa and the Son. The Ganges and its tributaries are not nearly as important as highways as they used to be. They have been replaced very largely by the railways, and now their water is more valuable for irrigation purposes.

The Brahmaputra rises on the slopes of the Kailas mountains near the Manasarowar lakes and during its Tibetan course it is known as the Tsanpo. After running a course of about 900 miles eastward it bends south eastward across the Himalayas and during this part it is called Dihang. It then turns sharply southwards at Sadiya below which it is navigable, though it is somewhat difficult between this place and Dibrugarh.

In the neighbourhood of Sadiya it is joined by several mountain rivers, *viz.*, the Dibang, the Lohit and the Dihing and none of them are useful for navigation. Among the Himalayan tributaries the Tista is the most important and is useful for navigation for a considerable distance.

The rivers of the Deccan flow either eastward or westward. The general slope of the plateau being eastward, with the continuous, high Western Ghats at the back and close to the coast, the rivers flowing eastward are large, while those flowing westward (with the exception of the Narbada and the Tapti) are very short and useless for navigation. The big rivers, like the Mahanadi, the Godavari, the Kistna and the Kaveri, which flow into the Bay of Bengal are not useful like the rivers of Northern India for navigation because they flow over the dry Deccan tableland with small rainfall and come out of narrow gorges as they run down into the bay from the Eastern Ghats. They are therefore useful for navigation and irrigation only in their lower courses. The Narbada and the Tapti, separated from each other by the Satpura Range, run nearly parallel to each other. After passing through the rocky uplands with falls and rapids they flow through narrow fertile valleys to the Gulf of Cambay. Since they have no deltas at their mouths, they are navigable by small ships from the sea for about 60 miles up their courses in flood time. Surat, at the mouth of the Tapti, was the most important port during the Mahomedan rule and the first British factory was set up there. The Gulf of Cambay has, of recently years, silted up to a marked degree.

We have already said something about the Irrawaddy which is even more important to Burma than the Ganges is to the plains of Hindustan and Bengal.

With its tributaries it drains the Central Plain of Burma, the most important and fertile region in the province. As the mountains run north and south in parallel ranges the streams from the east and west are short and so also communication from east to west is difficult. The Irrawaddy, like the Ganges, is formed by the two mountain streams of the N'Mai kha and the Mali kha, but, unlike the Ganges, it flows for the first half of its course along narrow valleys shut in by mountains and has therefore not many large tributaries like the great rivers of Northern India. Among its right hand tributaries the Mu and the Chindwin are worthy of note. The latter is nearly as large as the main river and is navigable for several hundred miles by flat bottomed steamers, *i.e.*, up to Pantha in the dry season and Homalin in the wet season.

On the left bank the Irrawaddy receives the drainage of the Shan hills and Pegu Yomas, the most important tributaries on this side are the Shweli and the Myitnge. As they rise in the undulating and mountainous Shan Plateau and descend suddenly into the plains they are not of any use for navigation except for a short distance near their junctions with the main river. The Sittang drains the low plains between the Pegu Yoma and the Shan hills and empties its burden into the Gulf of Martaban. It is useless for navigation because it is blocked by sand-banks and is subject to a bore. To help navigation a Canal called the Pegu-Sittang Canal has been cut. The Salween, as already noted, is not of much use for navigation for it has rapids only a hundred miles from the mouth, but in its upper course in the Shan States it is more or less navigable though not much used.

The rivers of Australia are of little use for navigation because the short coastal rivers, except those on

the east coast, suffer from want of water. Some of them are nothing but dried up water courses during the dry season. Of the larger rivers only the Murray flows continuously throughout the year. Navigation even in this river is difficult owing to the existence of sandbanks and shallows and of a sandbar at its mouth which necessitates transport of goods by land for a considerable distance. It is navigable for steamers of shallow draught up to Albury. Small steamers navigate the Murrumbidgee and the Darling for some distance in the wet season.

The chief defect of the African rivers is that they have rapids at a small distance from their mouths. This defect is caused by the relief of the Continent, which is formed by a gigantic plateau. Excepting in the north-east, there is a sharp edge to the plateau and the rivers fall abruptly to the low marshy coastal plains. The rivers are therefore of little use for traffic and this is one of the most important causes of the slow development of Africa. Even her largest river, the Nile, is not free from the general defect. In its upper course it flows through rocky beds giving rise to rapids; in its middle course when it enters the level highland of the Sudan the river is liable to be blocked by masses of vegetation (sudd) and thence it descends by six cataracts to the plain. In the delta and its lower course the Nile is navigable. It was in ancient times the only means of communication between Egypt and the Sudan and it is still the highway of commerce in Egypt. Railways have been constructed to avoid the rapids on the rivers.

The other important rivers of Africa are the Congo, the Niger, and the Zambesi. The Congo rises in the highlands between Lakes Tangayika and Nyasa. The main stream drops into the depression at Stanley Falls

and is navigable down to Stanley Pool. Then it enters a narrow gorge and again falls suddenly from the edge of the plateau at Livingstone Falls, below which it is navigable for about 100 miles to its mouth. The Niger, which is 2,600 miles long, is also like the Congo navigable in its middle and lower courses. The Zambesi rises near the Kasai tributary of the Congo. It drops over the Victoria Falls into a narrow gorge and is navigable for a considerable distance in its lower course but in its deltaic course it is not useful for navigation.

CHAPTER VIII.

Transport by land.

There are various ways of carrying goods by land, but the chief mode of land carriage in all civilized countries in modern times is by railway. In ancient times goods were carried either by people or by animals. But such a mode of carriage is now fast disappearing, except in places where there are no good roads. The beasts of burden such as the donkey, mule, bullock are used only in the carriage of goods for short distances. Animals are, however, still commonly employed in carrying goods from an agricultural, mining or railway station. Where there are fairly good roads bullock carts, hand carts and motor lorries all share in the work of local transport.

Though almost every civilized country is now covered by a net work of railways and roads yet there are some parts of the world where good roads are practically unknown and railways scarcely exist. This is very often the case in mountainous countries within the tropics or in their neighbourhood, *e.g.*, Ecuador, Afghanistan, Persia. In such places roads are very few in number and are generally too rugged for the use of horses. The animals used in these places are very often donkeys, mules, camels, bullocks, elephants, yak, lama etc. In some places human porters are also used.

Asses and mules are usually employed for transport in the warmer parts of the temperate zone. They are noted for their endurance and surefootedness, and are, therefore, largely used in the hilly and dry parts

of the south of Europe and Northern Africa. Mules and Camels are also used in the same regions but for different work. As transport from Bushire to Shiraz in Persia lies through a rugged country, mules are employed for their surefootedness whereas camels are employed in the transport from Shiraz to Ispahan for the way is across a desert. In fact camels are essentially desert animals. They can travel for days without food and drink, and their broad feet do not sink

Fig. 61. Camel Transport in North West India.

into the desert sand. Owing to these special faculties they are generally employed on caravan routes in the deserts of Africa, Asia and Australia. Sometimes more than 1,000 camels are used in a single caravan.

Elephants are of great use in tropical swamps. They are greatly needed in the carriage of heavy goods in mountainous and rugged regions. In early times, they were employed in War and they even now carry guns. In some places, *e.g.*, Burma they are commonly

engaged in dragging felled trees in the forests and in piling heavy logs of wood. Bullocks are very common in Africa and other warm parts of the World. They are used in different parts of the World for altogether different purposes. On the hard plains of South Africa they are used for drawing waggons as well as for ploughing; in India for ploughing fields and drawing carts. Oxen are very often used for war transport. During the last French Campaign in Madagascar, Indian Oxen were used because the bites of a small insect, called the carapet, were fatal to both horses and mules. Bullocks are of such common use in South Africa that even now they are used by the natives as money and even a wife can be had for a few oxen.

The yak and lama are commonly employed in the carriage of goods amongst the snowy passes of mountains like the Himalayas and the Andes. Much of the tea trade between China and Tibet is done by the help of the yak. So also much of the wool between Tibet and Kashmir is carried by the yak. Before the opening of railways from Mollendo the silver mining industry round Cerro de Pasco and other places in the Cordillera of Peru was dependent on the lama.

Other animals capable of bearing cold, such as dogs and reindeer, are usually used for draught in cold countries. In Denmark dogs are often employed in drawing small carts and in the polar regions sledges are drawn by dogs. The reindeer is used by the Lapps, Finns and other inhabitants of the mossy Tundras.

Human porters are more or less used all over the World. They are, however, especially used in Africa and Asia. Along certain belts in Africa, *e.g.*, in parts of the Zambesi Basin there is a kind of insect, called the tsetse fly, the bites of which are fatal to horses and

FIG. 62. ELEPHANTS AT WORK MOVING TIMBER.
(*From Stamp's 'A First Geography of Burma.'*)

to cattle. So human porters are very common in such belts. They are very largely employed in the monsoon lands of Asia, more specially in China and the Malayan peninsula. They are also quite common in India and Burma.

In countries where good roads abound, horses are generally used and are the best transport animals. They can draw about 25 times as much as they can carry and about twice as much in a four-wheeled cart as in a two-wheeled. They are very largely used in Europe and all other places where there are good roads.

Now all over the world the pack and caravan system of transport is being supplanted by railways for three reasons. It is more expensive, takes more time, and is more uncertain and unreliable than transport by rail. Transport by rail may be costly when compared with water transport, but it is free from the other two defects. On the contrary its greatest advantages are its speed and reliability and its greatest disadvantage its cost. The element of risk is very small, the danger of a collision is now fast disappearing and serious accidents are rare.

The cost of railways varies with the character of the ground they traverse. If the ground is undulating *i.e.*, up and down, the cost is bound to be serious. This is especially the case if the ground is marshy or mountainous. On level ground, however, the construction of railways is easy and cheap. Hence to avoid heavy expenditure railways follow natural routes or the line of least resistance wherever possible.

The size of a railway is reckoned by the distance between the two rails, which is called the gauge. Over nearly the whole of Europe except Russia and Spain and over nearly the whole of North America the

" standard gauge " of 4 feet $8\frac{1}{2}$ inch is used. In India there are two gauges, the broad gauge of 5 feet 6 inch and the narrow or metre gauge (3 feet $3\frac{3}{8}$ inch). In South Africa and Japan and part of Australia the gauge is 3 feet 6 inch. Narrow gauge railways are cheaper to construct than broad gauge. The narrow gauge rails can be taken round sharper curves and so are often used in hilly regions where the line must be made to curve a great deal. But narrow gauge trains cannot travel so quickly as broad gauge trains, and the load carried is much smaller.

In spite of their cost railways are now for various reasons overcoming physical obstacles or barriers. Streams and gorges are being bridged and mountains pierced by tunnels or crossed by spiral or zig-zag railways. Modern engineers now choose the line of ultimate least resistance, and not the line of immediate least resistance, in the construction of rail roads. Formerly the Alps cut off communication between Southern and Central Europe. Now several expensive cuttings and tunnels across the Alps to a large extent have removed the obstacle to movement north and south as well as east and west. The most important line north and south runs through the St. Gothard tunnel. Milan commands this route on the Italian side and Basel on the German frontier. The most important east and west route is through Mount Cenis. This route is controlled by Turin on the Italian side.

Similarly by expensive engineering work the Rocky Mountains have been crossed by several railways which give through communication between the Atlantic and the Pacific sea boards of North America. The Canadian Pacific in British North America is one of them. It runs from Halifax and St. John (the winter ports of Canada) to Quebec and Montreal, the summer ports.

From Montreal it follows the Ottawa River to Ottawa and then runs through the forest belt to the nickel mines of Sudbury and on to Port Arthur and Fort William on Lake Superior. Thence it runs *via* Winnipeg, across the agricultural and pastoral regions of the central low lands and then passing through the Rocky Mountains by the Kicking Horse Pass it runs right across the mineral belt to Vancouver. Besides Winnipeg the chief towns in the central low lands or prairie belt are Regina, Medicine Hat and Calgary and these in the mineral belt are Kamloops, Yale, New Westminster and Vancouver.

Though the Canadian Pacific was built in the first instance for political reasons yet it was undertaken not by Government but by enterprising private companies. The Indian railways had been found to be highly profitable. So the capitalists were attracted to begin the Canadian Pacific as a purely commercial concern. In fact, it has amply fulfilled the expectation of its organisers and is now a great source of income to the share-holders. It has rich deposits of coal at its two ends and they are close to the harbours of Halifax and Esquimault. Its strategic importance is indeed very great. It is not only very helpful in the governing of the vast dominion of Canada by affording rapid communication between east and west, but it is also very important from the Imperial point of view. This line shortens the distance from Liverpool to China and Hongkong by about 1,200 miles. It would be an invaluable route to India in case of War with France or any other Mediterranean power, for then the Suez Route would be too dangerous. The value of this line to the commerce of Canada is incalculable. In fact Canada owes much of its present development to the C. P. R.

The United States of America possess the most extensive net work of railway lines in the world and have no less than four transcontinental routes. They are (1) the Northern Pacific (2) the Union Pacific, (3) the Central Pacific and (4) the Southern Pacific. The Northern Pacific runs from the lake-port of Duluth to Portland on a bend in the Columbia river.

The two great railway centres in the middle plain, Chicago and St. Louis, are joined by lines to the Atlantic Coasts, and they may be called the pivots of the main railways of the States. The main lines start from Boston, New York, Philadelphia and Baltimore on the Atlantic coast. The line from New York runs along the Hudson to Albany where another line from Boston meets it. Thence it continues through the Mohawk Valley to Buffalo, a port on the eastern end of Lake Erie and on to Chicago, the greatest trade centre of the grain belt of the States. A line from Chicago runs through the wheat belt *via* St. Paul and Minneapolis and, following the Yellowstone Valley, joins the Northern Pacific at Helena. A second line from the same centre runs to San Francisco, collecting wheat between Chicago and Omaha, cattle between Omaha and Cheyenne and minerals between Cheyenne and Ogden. At this last town this line, the Union Pacific, joins the Central Pacific. The latter runs from St. Louis, the chief centre of the maize belt, to Kansas and through the mineral district of Denver and Leadville to Salt Lake City and Ogden.

The line from Philadelphia follows the Susquehanna gap to Pittsburg, the most important mining and industrial centre in Pennsylvania, and from there it runs to join the Union Pacific at Chicago. The line from Baltimore runs to Cincinnati, one of the most important towns in the maize belt, and thence it pro-

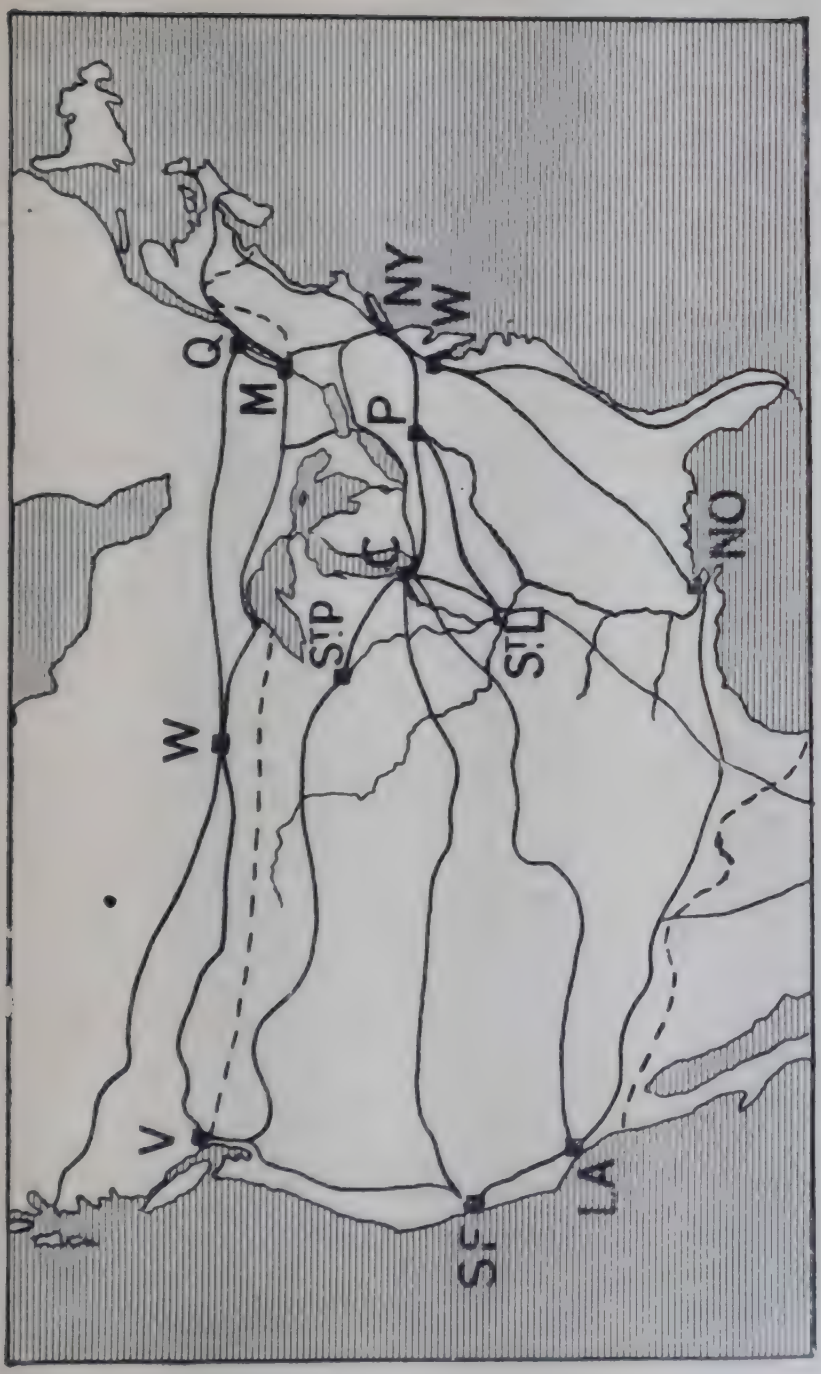

FIG. 63. THE RAILWAYS OF NORTH AMERICA, SHOWING THE MAIN TRANS-CONTINENTAL LINES.

ceeds to St. Louis where it joins the Central Pacific. A coastal line runs from St. John through Portland, Boston, New York, Philadelphia, Baltimore, Washington, Charleston to Florida Keys; with another line from Washington to New Orleans. The last town is joined to San Francisco by the Southern Pacific *via* S. Antonio and El Paso del Norte.

In South America there is only one transcontinental route. The reason for this paucity of through routes is that the Andes form a more formidable barrier than the Rockies and the South American continent is less developed than the North. It joins Valparaiso, the port of middle Chile, with Buenos Aires the port of Argentina. It required expensive tunneling under the Upsallata pass and was opened in 1910. This line has reduced the journey from Valparaiso to Buenos Aires by 6 days for the steamers take about 9 days to complete the journey whereas railways only take three days. Another Trans-Andean line is under contemplation. It seeks to connect Bahia Blanca, the port of Southern Argentina with Valdivia the southern port of Central Chile and, when completed, it is sure to develop the natural resource of both countries.

The Trans-Siberian railway in Euro-Asia is a wonderful piece of engineering work. It connects Valdivostok, the most easterly naval station of the Russian dominions, with Leningrad (Petrograd), the former capital of Russia. The necessity of this line was keenly felt during the Crimean War when the Governor of Eastern Siberia gave some practical suggestions, but the work was not undertaken till 1891. From Leningrad and Moscow the line runs through comparatively level lands until Irkutsk at the southern end of Lake Baikal is reached. The important towns

on this long stretch are Samara, Omsk, Krasnoyansk. From Irkutsk it follows the Shilka, a tributary of the Amur, and crosses Chinese Manchuria to the Russian port of Vladivostok. During its construction no real engineering difficulty was experienced till the line reached the neighbourhood of Baikal. At first this appeared unsurmountable and for a long time the practice was to send passengers across the lake by steamer in summer and to run the train across the ice in winter. In the east of Lake Baikal, also, a great difficulty was found in taking the line across the Yablonoi Mountains. Such a huge sum has been spent in cutting and tunneling that this section of the line will probably never pay. Between the Ural Mountains and Irkutsk the line goes through some of the richest wheat growing and mineral districts of Siberia and is very likely to attract population and foster industry. From Moscow there are lines to Warsaw and Riga from which town there is direct communication by railway with Berlin and with Amsterdam, Rotterdam and other ports on the North Sea. There is thus an uninterrupted connection between the Atlantic and the Pacific, except for the break of gauge between the Russian railways and those of Western Europe. Another very important route in Eurasia is the Trans-Caspian Railway which leads from Moscow *via* Orenburg to the neighbourhood of Sea of Aral. From here it runs along the Syr Valley to Tashkend and Samarkand in Turkistan (Central Asia). Through the towns of Bokhara and Merv there is communication with Kabul and Herat in Afghanistan. There is another line from Merv to the Caspian Sea, whilst Baku on the opposite shore of the Caspian is connected directly with Moscow and Western Europe. It may be added here that when the proposed line between Herat and

Kandahar is completed the Indian Railways would be joined directly to the Trans-Caspian Railway.

In Africa there is a large and efficient net work of railways in the south—in the Union of South Africa and Rhodesia. In other parts of Africa railways connect most of the important ports with leading centres in their hinterlands. In other parts short lengths of railway circumvent rapids on the rivers and so com-

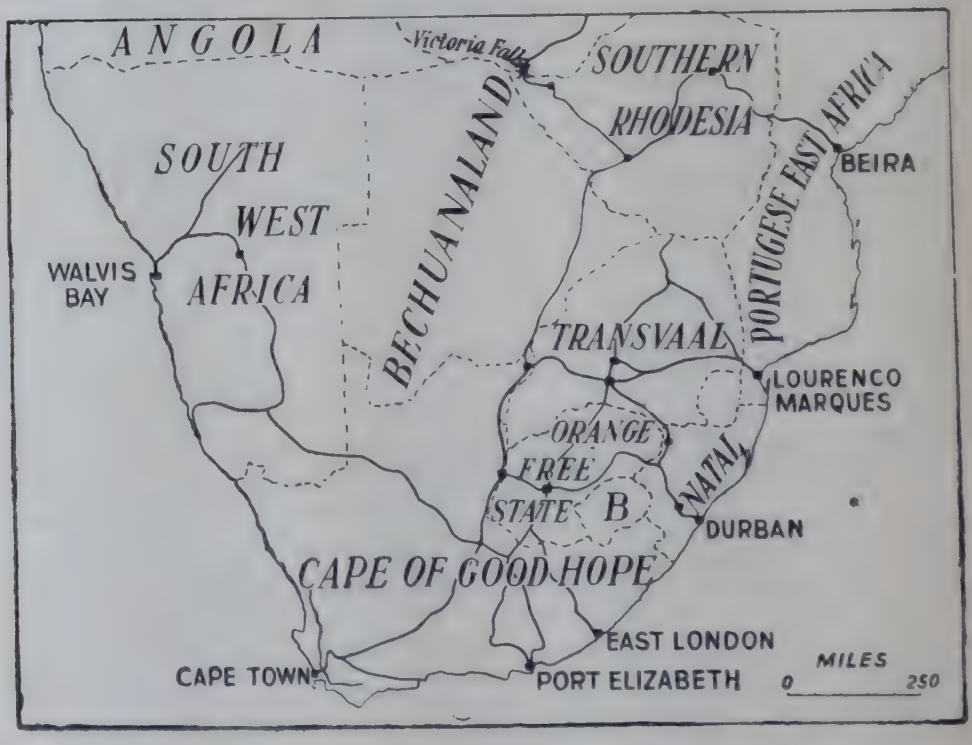

Fig. 64. The Railways and Ports of South Africa.

plete the chain of water transport. But as yet Africa has no great trans-continental railway route. One has long been planned to connect Cairo and the Cape but is still far from complete.

In Australia the extreme west is now connected with the important states of the east by a trans-continental railway. But Australian railways suffer from one terrible disadvantage. Each state started build-

ning railways on its own, and each built them on a different gauge, so that there are three separate gauges in use in Australia. In travelling from Fremantle or Perth to Brisbane it is necessary to change trains eight times.

Let us now close the Chapter with a short review of the benefit of railways. They are indispensable for

FIG. 65. THE RAILWAYS OF AUSTRALIA.

the development of the resources of a country and in opening up new lands their value can never be over-estimated (as in Canada). By permitting the free movement of labour from the densely populated or poor places to the places where labour is badly needed they not only save the poor labourers from starvation and misery and relieve the people who stay behind from

the pressure of increasing population but they also d good to the places to which they carry the labourer For instance, railways now enable the poor labouring class to go from the United Provinces, Bihar an Orissa to distant tea plantations in Darjeeling an Assam. Railways have, therefore, not only solved th labour problem to a considerable extent and opened t the poor people new avenues of earning their dail bread, but have also increased the output of the locali ities which they open up, much to the benefit of th manufacturers and consumers. Railways are indis pensable to an orderly government, for they are ver helpful in the quick mobilisation of troops. Whe ever there is any serious disturbance in any part of country, railways enable the authorities to concentrat troops and police forces, and very quickly to restor order. We have noticed that the necessity of a rail way line right through the vast Russian Empire wa first felt during the Crimean War. In India to keep the turbulent Afghans living on the border under control several railway lines have been opened in th North-west Frontier Provinces and the Punjab, on has just recently been completed through the Khybe Pass. They are called strategic railways to distin guish them from commercial railways which are buil primarily for trade.

As a rapid means of transport the influence o railways on the price of commodities is very marked By quickly sending away the surplus products of province or district to a place where such products ar wanted they tend to equalise the price of a commodity over a large area. Cheap postage and the daily pres would not have been possible without them. Th necessity of railways in a vast country like India an Burma can never be over-emphasized. They have re

moved the scourge of famine from the land and there is no famine now in the sense that it existed before the laying of railway lines. Although in this Chapter we have emphasized the great trans-continental routes, it must be remembered that these would not have held their importance were it not for the existence of the short "feeder" lines.

In these days much is heard of the importance of aerial transport. Aeroplanes are used for carrying certain mails between large cities in Europe and America, as well as in Australia. But for the carriage of merchandise, aerial transport has not reached the stage of wide application, for at present the cost is prohibitive.

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